

# The Iron Age

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A Review of the Hardware, Iron and Metal Trades.

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Published every Thursday Morning by DAVID WILLIAMS, No. 83 Reade Street, New York. Entered at the Post Office, New York, as Second-Class Matter.

Vol. XXXIII: No. 7.

New York, Thursday, February 14, 1884.

\$4.50 a Year, Including Postage.  
Single Copies, Ten Cents.

## Single-Stand Steam Hammer.

The annexed illustration represents a 3-ton single-stand steam hammer recently turned out by an English firm, Messrs. Thwaites Bros., of Bradford.

The *Mechanical World*, from which we take the engraving, in the course of its description remarks that the use of double-standard hammers, though very necessary for work of an excessive weight and for hammers of extraordinary dimensions, has extended, in the opinion of many engineers and forge makers, too far down the scale of sizes, for there can be no doubt that the single-standard hammer is specially suitable and convenient for use in certain classes of work, and that it can be substantially and satisfactorily constructed in sizes very considerably larger than has hitherto been the case. Messrs. Thwaites have given to this tool a great amount of attention, and have materially improved it in both durability and efficiency for the description of work to which it is suited—namely, marine shafts and large forgings. The frame is of cast iron; if desired, may be made with standards of wrought iron. The motion work is of the best Low Moor iron, suitably case-hardened in the joints, which are fitted with steel pins, and all working parts are machined to accurate fits, the valve motion having received special attention. The cylinder is 28 inches in diameter, the stroke being 5 feet, and is firmly bolted to the standard by turned bolts, the holes being reamed true when in position. The box section has, of course, been adopted for the standard to secure rigidity and firmness, and has an average thickness of  $3\frac{1}{2}$  inches. The piston-rod, which is 14 inches in diameter, is planed with two longitudinal flats upon it, which, being fitted accurately in the gland of the stuffing-box, serve to prevent rotation while in action.

The tendency of a hammer tup to rotate is not excessive, and, with stout piston-rods, planed flats are considered superior to the method of guiding the tup which is essential in the case of thin piston-rods. The use of the thick rod, dispensing with the slide guides, gives greater accommodation for the work on the anvil at the standard side. With guides to the tup head this space is not available. The rod, as well as the piston and the hammer head, are forged in one solid piece, the base of the cylinder and the stuffing gland being in halves and bolted strongly together to admit of this solid forging being placed in position, as seen in our illustration. The pallet or hammer face is of steel, of specially selected tough mixture for durability. The valve is of the piston type, perfectly in equilibrium, and fitted with four rings of steel to insure steam-tightness, and the stop-valve, circular in form, is of gun metal, the seat also being of the same material. The steam-ways in the seat consist of a number of small holes, this being done to insure easy control in opening and closing the valve. Both the stop-valve and the working-valve are conveniently arranged in the same chest, the working-valve being controlled by hand-levers, which are carried down to near the ground at the back of the standard, and the stop-valve being worked by the hand-wheel screw and levers visible above the working handle on the standard side. Such a hammer as we have described requires a good anvil, and this consists of a hard face of best steel dovetailed into the anvil top, which is also of steel, but of a mild quality, and is in turn secured by bolts to the anvil block proper, a casting 24 tons in weight, bedded carefully on a substructure of heavy logs,  $13 \times 13$  inches, of a depth of 2 feet 2 inches, laid on stone 1 foot 6 inches thick and bedded on concrete, which is carried down to a solid substratum in the most approved manner, the hammer standard being bolted by eight  $2\frac{1}{2}$ -inch bolts to a strong, firm foundation of two layers of timber 12 inches square, seated on dressed ashlar stone 3 feet thick, fixed on an independent concrete bed.

M. Errington de la Croix has calculated the velocity of propagation of the tidal wave caused by the volcanic eruption of Krakatoa. The final moment of the explosion was about 12 minutes to noon, when a gigantic wave was formed in the Straits of Sunda. But the same day, at 1.30 p. m., a tidal wave was felt on the coasts of Ceylon, notably at Point de Galle. Assuming that this was the same disturbance propagated across the 1800 miles of sea dividing Point de Galle from Sunda, M. de la Croix calculates the velocity of propagation to be some 1200 miles per hour, or 1804 feet per second. Further data from the Island of Mauritius affords a check on this result. Here the distance is 3300 miles from Sunda, and the tidal ebb was felt at 2.15 p. m. Hence the speed per second works out as before—1804 feet.

A feed-water heater of novel construction for boilers may be briefly described as follows: It consists of a strong cylindrical vessel having an inlet-pipe at one end and an outlet-pipe on the other. The inlet-pipe connects with steam exhaust of engine. Within the cylinder is a worm extending nearly from end to end. The inlet and outlet of this worm are preferably at the same end of the cylinder, the former leading to the feed pump and the latter to the boiler. A smaller hollow sheet-metal vessel is suspended centrally within the worm. The exhaust steam from the engine, entering the cylinder, flows through the same in contact with the coil of pipe

through which the feed-water circulates on its way to the boiler, thus heating the water to a high temperature. The steam, having performed its work, finds its way out, considerably condensed, of course, through the outlet provided for that purpose. The effect of the interior suspended vessel is to cause the hot steam to impinge with more force than would be the case if it were omitted. This feed-water heater has been patented by R. Tarrant, of Chicago, Ill.

## Restricting Iron Production in England.

A renewed attempt to carry out the principle of restricting the output in the North of England iron trade, says the London

Times, is being attempted by the pig-iron producers of the Cleveland district. The immediate cause of such action being taken is the very low price to which pig iron has declined. A continuous fall in prices occurred last year, a reduction of rates to the extent of 7/ per ton taking place. Since the present year commenced a still further reduction took place, and a few days since Cleveland No. 3 had touched 35/6 per ton, with prospects of a further decline. It was under these circumstances that the Cleveland ironmasters began to draw together with the view of strengthening the prices of iron and improving their position, as in most cases no margin of profit, or scarcely any, was left to the producer, while in cases where firms were not well placed—either geographically, as regards access to the sea-board, or in contiguity to the raw materials of ironstone and coke—a positive loss was incurred. The low prices of pig iron which have existed for the last few weeks were never paralleled in the history of the trade, except for a few months in the year 1879, since which time the output has increased by close upon 1,000,000 tons, the production in 1879

being 1,781,443 tons, while last year it had risen to 2,760,740 tons. Concurrently with a reduction of prices of Cleveland iron last year there was a diminution of stocks, and the end of the year found the stock in the district 253,105 tons, 13,000 tons less than at the end of 1882, while, as compared with the previous year, 1881, there was a reduction of 125,000 tons. It cannot, therefore, be said that the trade is overweighted with stocks of iron, there being less in hand, in point of fact, than for the previous six years. That prices should have continued to decline at a time when stocks were in process of reduction is contrary to general experience, and seems somewhat anomalous. The chief factor in bringing about such a result was probably the persistent decline of Scotch iron over a considerable portion of last year,

however, remain to be adjusted. The experiment, if carried out, will be watched with much interest. Whether it will achieve the object proposed—viz., to give a better return by raising prices in a declining condition of trade—is certainly open to some doubt. There is also the consideration that should the scheme succeed in this respect there is the possibility—indeed, the probability—of limiting the sale in distant markets both at home and abroad. In round numbers, 1,000,000 tons of Cleveland crude iron of all classes were shipped last year to foreign and coastwise ports. If Cleveland prices are raised by the measures proposed disproportionately to those of other districts, this large outside requirement must inevitably fall off. That the limited restriction undertaken in 1881,

## Introduction of Electricity in Lighthouses.

Sir James Douglass and several other scientific gentlemen, says the *English Mechanics*, are about to institute a series of electrical experiments on behalf of the Trinity Board with their existing electric-lighting machinery and an enormous De Méritens machine, at the two lighthouses near Dover. Dynamo machines do not appear to rank as the best generators for lighthouses, as Holmes's magnetic induction machines have held their own at this important lighthouse, and, among the trials about to take place, a De Méritens large-size magneto generator will be installed, which is expected to yield magnificent results. These machines of De Méritens will soon occupy all the lighthouses on the French coast, and it is a wonder these generators have been so little adopted in this country. Count du Moncel, in his translated little work, speaks of their high power as compared with the small force required to drive them. In this machine alternate currents are produced, and the whole of the armature current is utilized during its entire or part revolution. This form of armature also requires but little horse-power, on account of the peculiar arrangement of the circular magnetic field it rotates in, on a smaller scale, as in the factory machines, which yield about 1200 candle-power at about 750 per minute, and absorb only  $1\frac{1}{4}$  horse-power. The small machines contain about 3 cwt. of steel-inducing magnets, with their poles placed alternately N. and S., which operate upon 16 annular magnets forming a ring tire armature, which are arranged on the periphery of a brass wheel. Each annular magnet contains about  $1\frac{1}{2}$  pounds of wire, and the iron core is built up of pieces of iron, instead of being solid castings, which heightens the induction effects, and also prevents the formation of injurious Foucault currents. Two brilliant electric lights have hitherto been visible for many miles at sea from the South Foreland Lighthouse, but the experimental installation soon to take place will eclipse the light at present emitted from the two lanterns on the tower. It was from these lighthouses Professor Tyndall carried out his famous experiments on sound by a fog siren driven by the engines of the lighting machinery.

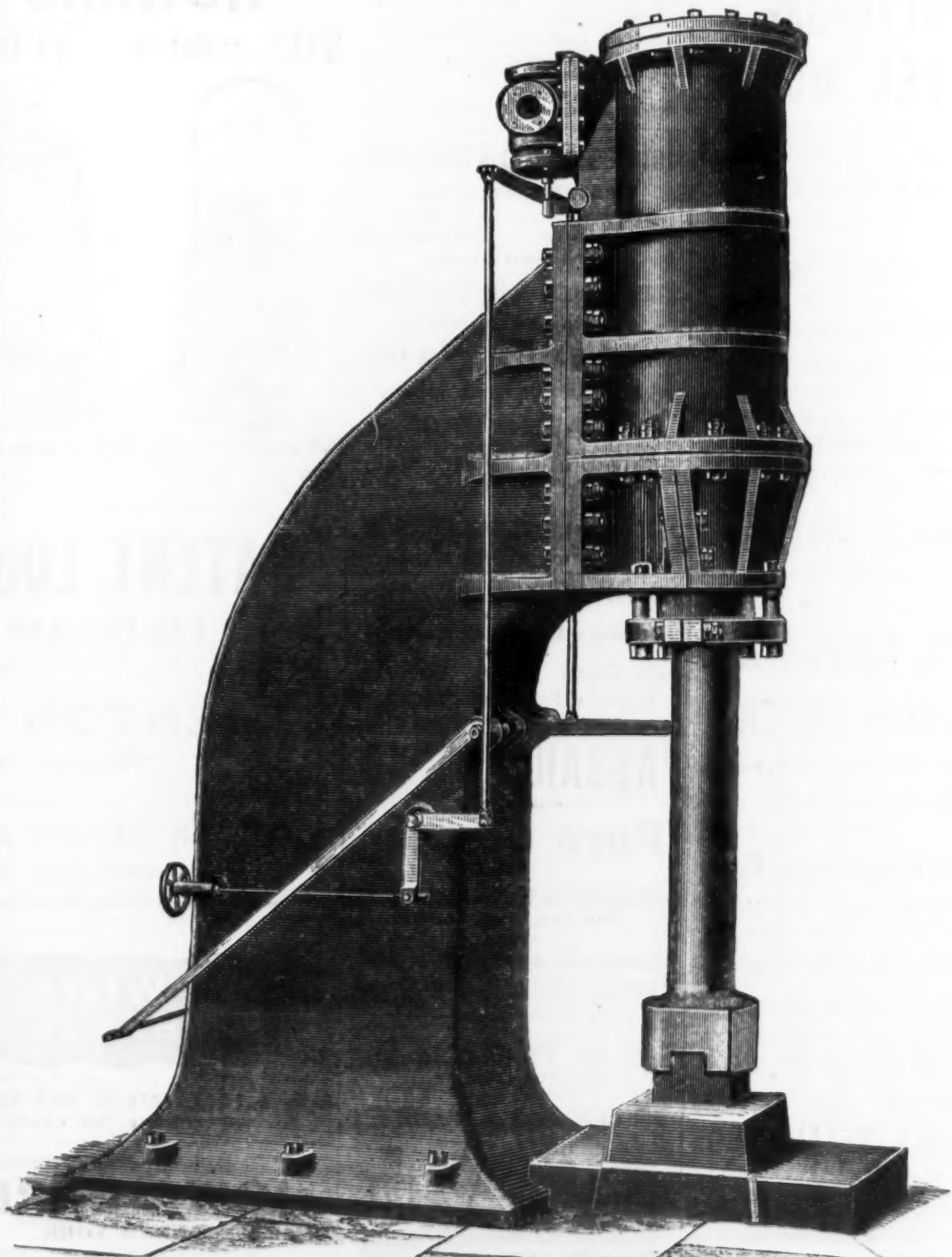
## A Large Machine Tool.

The San Francisco Tool Company, in conjunction with the Union Iron Works, of that city, are constructing what will no doubt be the largest machine tool of its class in this country. It is a machine for turning, planing and boring, and when completed is to weigh 120 tons. The reciprocating tools will traverse a plane,  $8 \times 25$  feet, with both vertical and horizontal action. The revolving table is 25 feet diameter, with 36 change of speed, and will mount work 30 feet in diameter. All boring, planing and turning appliances operate at angles with automatic feed operated by hydraulic power. In respect to its varied functions and the complexity of its movements, there is little doubt that this machine will, when completed, constitute one of the boldest ventures ever made in tool practice.

The design was prepared by Mr. J. Richards, of the Tool Company, instructed by Mr. Dickie, of the Union Iron Works Company, who has in this, as in many other things, ventured far beyond the usual lines of engineering practice. For those who may be curious to know the purpose of so large a machine of its kind, it may be explained that the Union Iron Works Company have recently made a grooved rope pulley that would have required nearly the whole capacity of the machine described, and that the new plant of the company will include the heaviest tools in use in this country.

A hydraulic flanging and shearing machine of 100 tons has just been moved into position. The whole works are underlain with a hydraulic system, hydraulic power being employed for various purposes, even to opening the vast doors of the erecting and boiler shops. In this connection it may be mentioned that Mr. Dickie has discarded the traditional cup-leathers in the hydraulic machinery, employing instead fibrous packing. The works, when completed, will cover 26 acres of ground, and the Pacific coast can boast of one of the most complete, if not the largest, works of the kind on this Continent.

We notice that the American Society of Civil Engineers has honored Mr. Wm. P. Shinn with the Norman medal for 1883, in recognition of the value of his papers on "The Increased Efficiency of Railways for the Transportation of Freight," and "How Can Railways be Made More Efficient for the Transportation of Freight?"



THREE-TON SINGLE STAND STEAM HAMMER.

(THWAITES BROTHERS, BRADFORD, ENGLAND.)

Times, is being attempted by the pig-iron producers of the Cleveland district. The immediate cause of such action being taken is the very low price to which pig iron has declined. A continuous fall in prices occurred last year, a reduction of rates to the extent of 7/ per ton taking place. Since the present year commenced a still further reduction took place, and a few days since Cleveland No. 3 had touched 35/6 per ton, with prospects of a further decline. It was under these circumstances that the Cleveland ironmasters began to draw together with the view of strengthening the prices of iron and improving their position, as in most cases no margin of profit, or scarcely any, was left to the producer, while in cases where firms were not well placed—either geographically, as regards access to the sea-board, or in contiguity to the raw materials of ironstone and coke—a positive loss was incurred. The low prices of pig iron which have existed for the last few weeks were never paralleled in the history of the trade, except for a few months in the year 1879, since which time the output has increased by close upon 1,000,000 tons, the production in 1879

while there was added during the autumn the influence of a probable large decline of the shipbuilding trade, which absorbs so much of the iron made in the North of England.

The prospective conditions, rather than any actual falling off of demand up to the present time, must be chiefly credited with the unsatisfactory state which at present prevails. The proposition before the Cleveland iron trade is to blow out 17 to 20 blast furnaces. These furnaces produce, on an average, close upon 400 tons per week each, so that the decrease in the output should the arrangement be carried out, will be a very material one. At present there are 117 furnaces in blast and 41 out of blast. If the proposed arrangement be carried out the furnaces blowing will be brought down to about 100. Combinations of a like nature have previously been entered into, but they did not embrace the whole of the ironmasters. It is now affirmed that the very depressed and stringent conditions under which the trade is placed have produced unanimity among the blast-furnace owners, and that the whole trade will be brought within the arrangement. Certain details,

and continued down to last year, had some effect in raising prices for a time there seems to be no doubt, but the conditions of the two periods are very diverse. At the former period there was an actively enlarging condition of trade, while at the present time trade is declining. For a while the Scotch ironmasters joined those of Cleveland in 1881-82 in reducing the output. It is not unlikely that an attempt will be again made to induce them to co-operate in the scheme now in process of arrangement.

Mr. L. J. Wing's new plan for elevated railroads, recently explained before the Rapid Transit Commissioners in this city, is not the least interesting among various similar projects now before the public. According to his ideas, the cars are to be suspended below an elevated superstructure and moved by an endless wire cable, the bottom of the car being 12 feet above the surface of the street, or about on a level with the second floors of ordinary buildings. It is proposed to have no stations in the streets, but to provide waiting-rooms in the buildings along the road. Passengers will enter the cars by



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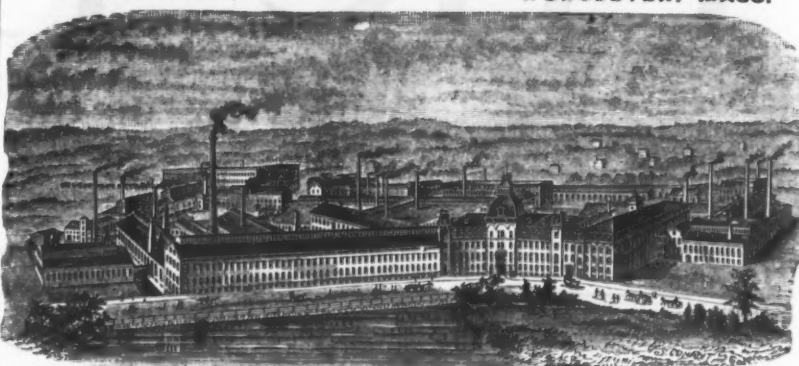
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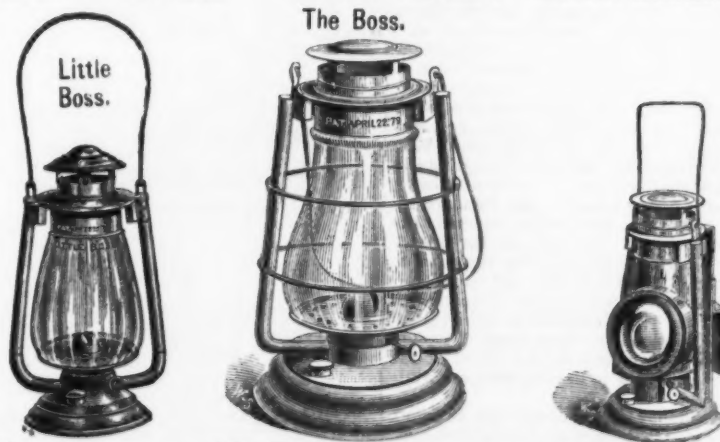
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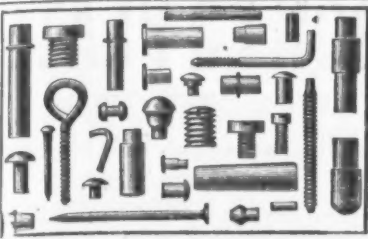


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FOUNDRY, MILL AND BESSEMER PIG IRON.

Plate, Bar, Railroad and Structural Iron, Spiegeleisen, Ores, Connelville Coke. Correspondence solicited.

## Exports of Agricultural Implements.

We have already noticed the shipment of two large lots of agricultural implements from this port for Russia direct. The last comprises about 40 carloads from Batavia, in this State. Agricultural implements have now been sent to Russia from this country for some eight years. Previous to that time the consignments were very small. They embrace reapers, mowers and harvesters, but not to any extent minor implements which cannot be called machines. The merits which American implements have over those which are manufactured in England—our principal competitor—are their greater adaptability and the better quality of the wood used in them. The English machines are well made and well adapted for work, but are in small variety, while those manufactured in the United States are in many styles. European woods are not so tough and enduring as ours, making the danger of breaking a great deal more. The total amount sent to Russia is perhaps \$150,000 a year, nearly all of it going at this season, so as to be exposed for sale early enough to be used with the growing crops. Freight to the Black Sea will average about 30/ a ton, and to St. Petersburg about 37/ or 38/. The navigation of the Baltic and the Atlantic to the latter port is regarded as much more dangerous than the Mediterranean and the Black Sea route, four vessels being cast away on the way to St. Petersburg to one to Odessa. There is a tariff on these commodities, but not an excessive one, and their use seems to be extending. None are made there.

The agricultural implement industry in the United States did not attain large proportions until about the time of the World's Fair in London, in 1850, when McCormick won a great success with his reaper. Since that time we have exported agricultural implements largely. There are now in the United States 1943 establishments which make these machines, 39,580 hands being employed, \$15,539,610 paid in wages, \$31,531,170 being the value of materials, and \$68,640,486 being the value of the product. They are made most largely in the West. Ohio produces yearly \$15,479,825; Illinois, \$13,498,575; New York, \$10,707,766; and Indiana, \$4,460,408. The towns which devote most attention to this industry are Springfield and Dayton, Ohio; Chicago, Ill.; Auburn, N. Y., and Louisville, Ky., each producing over a million dollars' worth of goods. Next after these come St. Louis and Philadelphia, each producing more than three-quarters of a million. The number of establishments in each State and the amount of goods produced are as follows:

	Number.	Value.
Alabama	20	\$13,075
Arkansas	11	9,985
California	31	389,500
Connecticut	21	832,500
Delaware	12	67,400
Georgia	30	300,124
Illinois	280	11,306,955
Indiana	96	5,311,818
Iowa	58	1,185,380
Kansas	14	72,450
Kentucky	26	2,396,037
Louisiana	1	3,000
Maine	38	726,300
Maryland	36	835,400
Massachusetts	29	310,400
Michigan	143	2,422,287
Minnesota	32	2,515,232
Mississippi	12	31,000
Missouri	74	645,772
Nebraska	13	31,550
New Hampshire	17	156,700
New Jersey	50	308,860
New York	365	9,540,000
North Carolina	31	132,860
Ohio	194	16,111,770
Oregon	4	35,000
Pennsylvania	220	3,462,021
Rhode Island	4	18,000
South Carolina	7	18,150
Tennessee	33	161,080
Texas	18	33,900
Utah	1	5,000
Vermont	35	640,900
Virginia	51	526,050
West Virginia	8	79,750
Wisconsin	108	3,747,095
Total	1,933	\$62,100,998

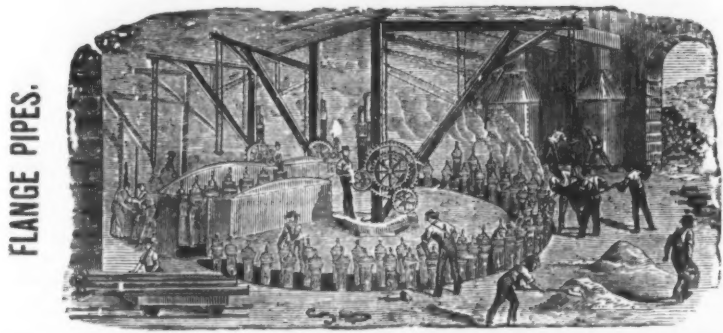
"The agricultural implement business," said a very extensive dealer and manufacturer, "is steadily growing, and at a greater rate than either population or wealth. Formerly our farmers could not afford to buy expensive machinery, and wheat was cut by the scythe, or, as I have heard old men say, by the sickle; now, on level ground, nearly all is cut by machines, and a really first-class hand mower is difficult to find. Steam engines are found in every neighborhood to use in agricultural work. There used to be a great scarcity of hands along about harvest time; but now, although they are still scarce, we have no difficulty in gathering our crops. Our machines and implements cover a great variety. They comprise corn planters, cotton planters, fertilizer distributors, grain drills, grain sowers, seed sowers, transplanters, clod crushers, cotton choppers, cultivators, harrows, hoes, plows, shovels, rollers, fruit gatherers, grain cradles, harvesters, hand rakes, hay forks, hay loaders, hay tedders, horse rakes, lawn mowers, mowers, potato diggers, reapers, reapers and mowers combined, scythe snaths, sickles, clover hullers, corn huskers, corn shellers, fanning mills, separators, thrashers, cane mills, cider and wine mills, feed steamers and boilers, hay and straw cutters, hay presses, horse powers, stalk pullers, stone gatherers, stump pullers and syrup evaporators. All these are made in quantities, the parts being interchangeable. Many of the factories that make them also make other goods which cannot be called agricultural. These works are of great size. One in Hoo-sick Falls covers 200 acres, and has increased the population of that village from 1000 to 6000. The works in Auburn each employ about 800 men, and wherever a successful manufactory is planted it is sure to increase the population of the town at least a thousand."

The recent explosion of a boiler in a Rochester, N. H., shoe factory is one of those regularly recurring cases of either criminal carelessness or extreme stupidity which always have been—and, we regret to say, very probably always will be—prominently connected with steam-boiler management. One of the daily papers, alluding to the accident, graphically described it by stating that the engineer "hung a brick on the safety-valve lever, with the aim of rais-



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For Edge and Turning Tools, Taps, Dies, Drills, Punches, Shear-Knives, Cold-Chisels and Machinists' Tools generally.

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For Boilers, Fire-Boxes, Smoke-Stacks, Tanks, &c.

All our Plate and Sheet Steel being rolled by a Patented Improvement, is unequalled for surface finish and exactness of gauge.

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For Shafting, Spindles, Rollers, &c., &c.

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"Iron Center" Cast Plow Steel. | Flashed Rolling Plow Coulters, with Patent Screw Hubs  
"Soft Steel Center" Cast Plow Steel. | Agricultural Steel cut to any pattern desired. | Attached.  
"Solid Soft Center" Cast Plow Steel. | Steel Forgings made to order.

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## THE MIDVALE STEEL COMPANY,

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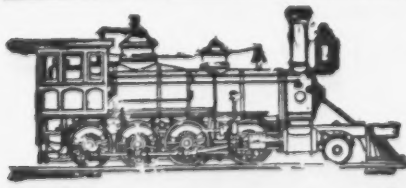
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Forgings for Piston Rods, Guide Bars, Wrist Pins and Machinery Purposes.

Works at Baldwin Station, Pennsylvania Railroad, near Harrisburg, Pa.

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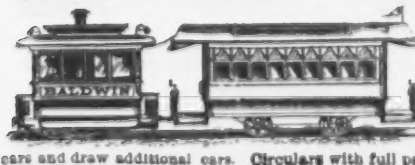
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**LOCOMOTIVE ENGINES**  
of every Description.

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For city and suburban Railways.

These machines are nearly noiseless in operation; show no smoke with the use of anthracite coal or coke as fuel, and show no steam whatever under ordinary conditions of service. They can be run at two or three times the speed of horse-cars and draw additional cars. Circulars with full particulars supplied.



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**STEEL RAILS, BLOOMS AND WIRE RODS,**  
Bessemer, Scotch and Charcoal Pig Iron,  
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For Marine and Stationary Engines.

Homogeneous Steel Boiler Plate, "Nashua" Brand.

Best YORKSHIRE BAR, "TAYLOR" IRON, for Stamped Work, Screws, etc., etc.

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Of All Descriptions.

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For Locomotive and Marine Boilers, Ship and Tank Plate, Spring, Tire, Machinery, Agricultural Steel, &c.

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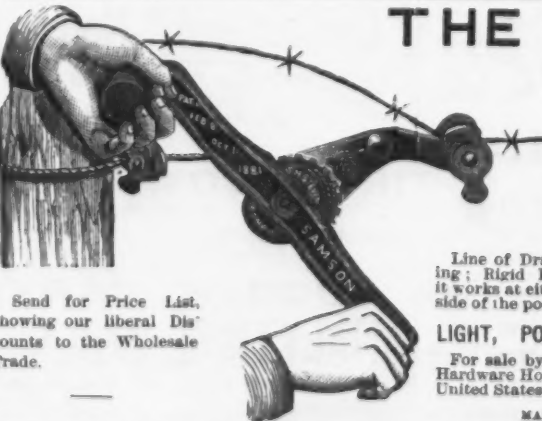
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SOLID STEEL CASTINGS.

QUALITY equal to Steel and Wrought Forgings. Can be Bent, Welded or Forged.

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## WIRE STRETCHER

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Line of Draft direct: always Self-Adjusting; Rigid Double Handle; Double Pawl; it works at either end of the fence, at either side of the post and either side up.

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AND IN CANADA BY

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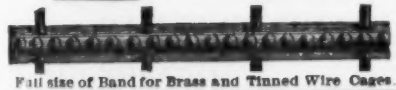
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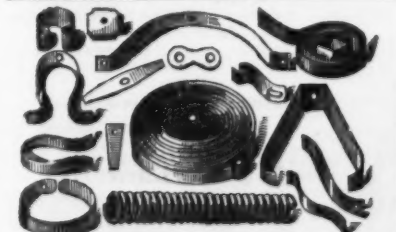


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**BRASS, BRIGHT  
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**Bird Cages.**

The cheapest and most  
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Catalogues and Price  
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Full size of Band for Brass and Tinned Wire Cages.



**DUNBAR BROS.,**

Manufacturers of  
**Clock Springs and Small Springs**  
of every description, from best Cast Steel,  
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**Schenectady Molding Sand Co**

**ALBANY AND SCHENECTADY  
MOLDING SAND**  
delivered on cars or boats at low rates. All grades  
guaranteed. All orders will receive prompt atten-  
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J. S. VEEDER, Pres.; J. G. GREENE, Sec. and Treas.

**MICHIGAN BLOCK WORKS.**  
Detroit, Mich., U. S. A.



Send for Catalogue and Price List.

**BUFFALO SCALE CO.,**  
BUFFALO, N. Y.,

Manufacturers of  
**R. H. Track Scales, Hay Scales, Coal  
Scales, Grain Scales, Platform  
Scales, Counter Scales, &c.**  
Send for price list, stating what you want.

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BRASS  
COLLAR,  
BRASS HINGE,  
Solid Lid,  
NO SOLDERING  
THE HINGE  
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MELT OFF

**HAMMER HANDLES.**

Hammer and Hatchet Handles for

Tool Makers.

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**PUMPS, HYDRAULIC RAMS, GARDEN ENGINES.**

Yard Hydrants, Street Washers, Galvanized Pump Chain, Wind Mill  
Pumps and other Hydraulic Machines in the World.

FIG. 120.



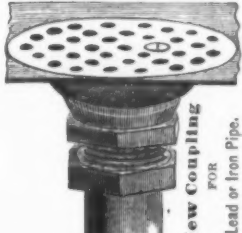
FIG. 209.



FIG. 70.



**Wrought Steel Sinks.**



One of the strong points of these sinks is the new coupling with which they are now supplied and which is pronounced by all plumbers the best on the market. It is used with both lead and wrought-iron pipe; is a neat, reliable coupling, and is easily detached for the purpose of pumping out the pipe. The strainer and all parts of the coupling are tinned, and are furnished with all sinks without extra charge.

The fact of the great strength and durability of this sink, as it is practically free from danger of breakage in transportation, handling or use, is a strong point in its favor, and that its merits are recognized by most competent judges is evident from the fact that leading houses which have been interested in the common article have taken up the Wrought Steel Sink. Twenty-five per cent. is saved in freight by purchasing Steel Sinks. Orders come from all parts of the United States, Canada, Europe and Australia.

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**PLAIN AND ORNAMENTAL BUTTS,**

LOOSE PIN REVERSIBLE, CAST FAST AND LOOSE,

Drilled and Wire Jointed, Japanned, Figured Enam-  
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Also a full line of

**IRON AND BRASS PUMPS,**

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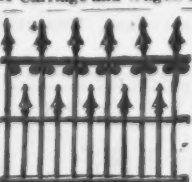
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ing an extra quantity of steam. He raised it; likewise the building." We need add nothing in the way of explanation, and only regret that, after all that has been said about the dangers of overweighing safety-valves, the practice should still be indulged in to so alarmingly great an extent.

**Report on Friction Experiments.**

BY BEAUCHAMP TOWER.\*

I. *Description of Machine.*—In experimenting on the friction of lubricated bearings and on the value of different lubricants, one of the difficulties which is first met with is the want of a method of applying the lubricant which can be relied upon as sufficiently uniform in its action. All the common methods of lubrication are so irregular in their action that the friction of a bearing often varies considerably. This variation, though small enough to be of no practical importance, and to pass unnoticed in the working of an ordinary machine, would be large enough to utterly destroy the value of a set of experiments, say, on the relative values of various lubricants, for it would be impossible to know whether an observed variation was due to a difference in the quality of the oil or in its rate of application. The first problem, therefore, which presented itself in the present experiments was to devise a method of lubrication such as would be perfectly uniform in its action and would form an easily reproducible standard with which to compare other methods. These conditions were best fulfilled by making the bearing run immersed in a bath of oil. By this method the bearing is always supplied with as much oil as it can possibly take, so that it represents the most perfect lubrication possible, and is a good standard with which to com-

and the journal when at rest), each experiment was tried with the journal revolving in both directions, and the sum of the values of  $s$  on both sides was measured, and then the coefficient of friction was indicated by the chord of the whole angle, included between the two lines of inclination caused by the friction, with the rotation in the two directions, expressed in terms of the diameter of the journal (see Fig. 4). Each result was thus a mean of two experiments, one with the axle running in one direction, and the other with it running in the other direction. In order to read the value of the coefficients thus obtained, a light horizontal lever,  $L$ , was attached (as shown in Fig. 1) to the frame connecting the brass to the knife-edge. It was  $62\frac{1}{2}$  inches long, or  $12\frac{1}{2}$  times the distance between the center of the journal and the knife-edge; so that at the end of the lever the chord indicating the coefficient of friction was magnified  $12\frac{1}{2}$  times. As a chord of 4 inches at the knife-edge represents a coefficient of 1, a chord of 50 inches at the end of the lever also represents a coefficient of 1, while 5 inches represents a coefficient of  $\frac{1}{10}$ ,  $\frac{1}{2}$  inch of  $\frac{1}{125}$ , and  $\frac{1}{10}$  inch of  $\frac{1}{1250}$ . The position of the end of the lever during each experiment was recorded by a tracing point attached to the end of the lever, and marking on metallic paper fixed on a paper cylinder,  $P$ . The distance between the two lines obtained by running the machine both ways, when measured on the above scale, indicated the value of the coefficient.

II. *Method of Experimenting.*—Early in the experiments it was found that, immediately after the motion of the shaft was reversed, the friction was greater than it was when the shaft had been running in the same direction some time. This increase of friction due to reversal varied considerably.

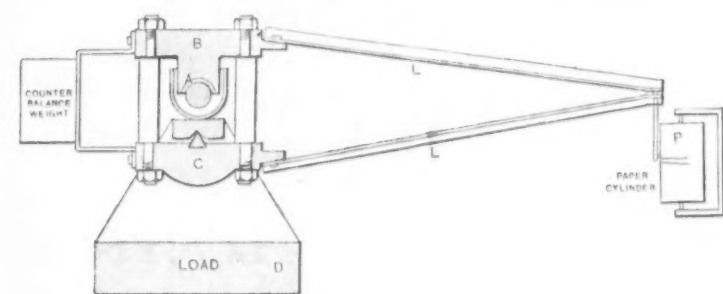


Fig. 1.

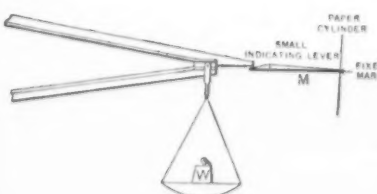


Fig. 2.



Fig. 3.



Fig. 4.

**FRICION EXPERIMENTS.**

pare other methods. It is at all times perfectly uniform in its action. It is very easily defined and reproduced, and it also has the advantage that the temperature of the bearing can be easily regulated by gas jets under the bath. Experiments showed that the bath need not be full; the results obtained were the same when it was so nearly empty that the bottom of the journal only just touched the oil.

The journal experimented on (see sketch annexed, Fig. 1) was of steel, 4 inches in diameter and 6 inches long, with its axis horizontal. A gun-metal brass,  $A$ , embracing somewhat less than half the circumference of the journal, rested on its upper side. The exact arc of contact of this brass was varied in the different experiments. Resting on this brass was a cast-iron cap,  $B$ , from which was hung by two bolts a cast-iron cross-bar,  $C$ , carrying a knife-edge. The exact distance from the edge of this knife-edge to the center of the journal was 5 inches. On this knife-edge was suspended the cradle  $D$ , which carried the weight applied to the bearing. The cap, bolts and cross-bar were put together in such a manner as to form a rigid frame, connecting the brass with the knife-edge. If there had been no friction the weight would have caused the knife-edge to hang perpendicularly below the axis of the journal. Friction, however, caused the journal to tend to carry the brass, and the frame to which it was attached, round with it, until the line through the center of the journal and the knife-edge made such an angle with the perpendicular that the weight, multiplied by the distance from the knife-edge to that perpendicular, offered an opposing moment just equal to the moment of friction.

Suppose  $r$  = radius of the journal (Fig. 3),  $s$  = distance of the knife-edge from the perpendicular,  $w$  = the weight; then  $s \times w$  = the moment of friction.

Now, the friction at the surface of the journal

$$= \frac{\text{the moment}}{r} = \frac{w \times s}{r}.$$

Hence the co-efficient of friction  
friction at surface of journal

$$= \frac{w \times s}{r} = \frac{w \times s}{r} = \frac{w \times s}{r} = \frac{w \times s}{r}.$$

So that the coefficient of friction is indicated by  $s$  in terms of  $r$ , no matter what the weight is. As an example, suppose  $s$  was equal to  $r$ ; the coefficient of friction would obviously be 1; or if  $s$  was  $\frac{1}{10}$  of  $r$ , then the co-efficient of friction would be  $\frac{1}{10}$ .

In order to avoid the difficulty of determining accurately when the knife-edge was perpendicularly under the center of the journal (a knowledge which was necessary in order to obtain a measurement of  $s$ , and which was very difficult to obtain, owing to the considerable friction between the brass

and the journal when at rest), each experiment was tried with the journal revolving in both directions, and the sum of the values of  $s$  on both sides was measured, and then the coefficient of friction was indicated by the chord of the whole angle, included between the two lines of inclination caused by the friction, with the rotation in the two directions, expressed in terms of the diameter of the journal (see Fig. 4). Each result was thus a mean of two experiments, one with the axle running in one direction, and the other with it running in the other direction. In order to read the value of the coefficients thus obtained, a light horizontal lever,  $L$ , was attached (as shown in Fig. 1) to the frame connecting the brass to the knife-edge. It was  $62\frac{1}{2}$  inches long, or  $12\frac{1}{2}$  times the distance between the center of the journal and the knife-edge; so that at the end of the lever the chord indicating the coefficient of friction was magnified  $12\frac{1}{2}$  times. As a chord of 4 inches at the knife-edge represents a coefficient of 1, a chord of 50 inches at the end of the lever also represents a coefficient of 1, while 5 inches represents a coefficient of  $\frac{1}{10}$ ,  $\frac{1}{2}$  inch of  $\frac{1}{125}$ , and  $\frac{1}{10}$  inch of  $\frac{1}{1250}$ . The position of the end of the lever during each experiment was recorded by a tracing point attached to the end of the lever, and marking on metallic paper fixed on a paper cylinder,  $P$ . The distance between the two lines obtained by running the machine both ways, when measured on the above scale, indicated the value of the coefficient.

This method of obtaining a direct indication of the coefficient of friction, by the angular displacement of the frame connecting the brass and knife-edge, would have undoubtedly been the best had the coefficient of friction been nearly as constant as it has hitherto been supposed to be. But, as shown by the tables of results, the coefficient of friction was found, instead of being constant, to be very nearly inversely as the load, and also to be much smaller in quantity than was expected; the consequence was that with high loads the height of the diagram was very small. In the cases where with the greatest loads a coefficient of  $\frac{1}{1000}$  was observed, the distance between the two lines was only  $\frac{1}{10}$  inch. The results regarding olive oil, lard oil, mineral grease and sperm oil as applied by baths were obtained in this way.

Owing to these experiments showing that the moment of friction was much more nearly constant than the coefficient, it was resolved to alter the method of observation and to measure the moment directly instead

\* Adopted by the Committee on Friction, and presented to the Council of the British Institution of Mechanical Engineers, September 28, 1883.



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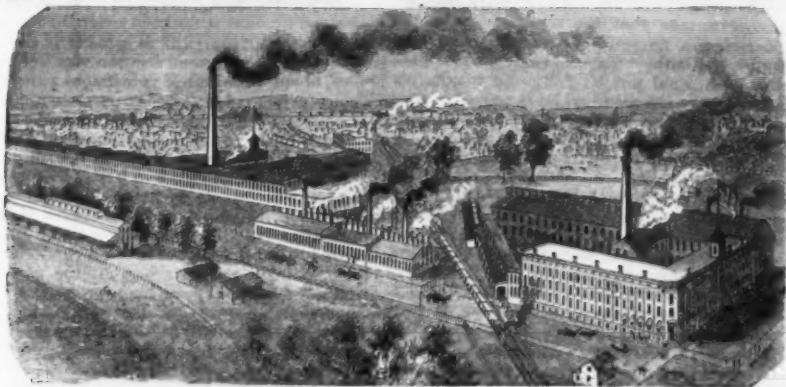
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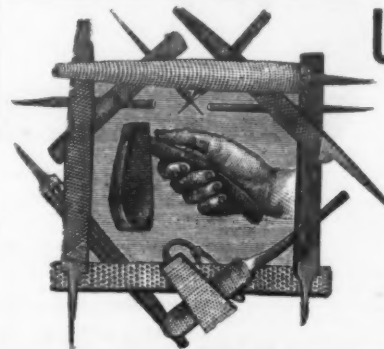
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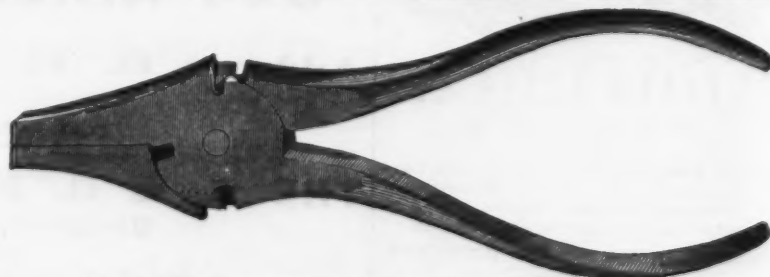
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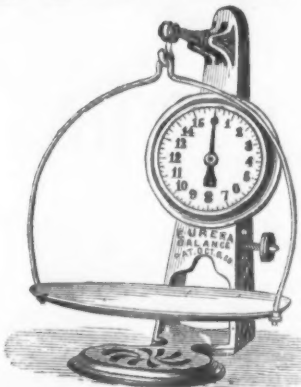
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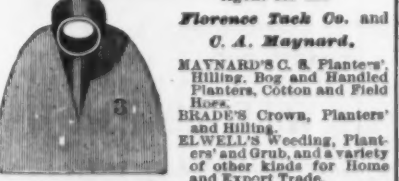
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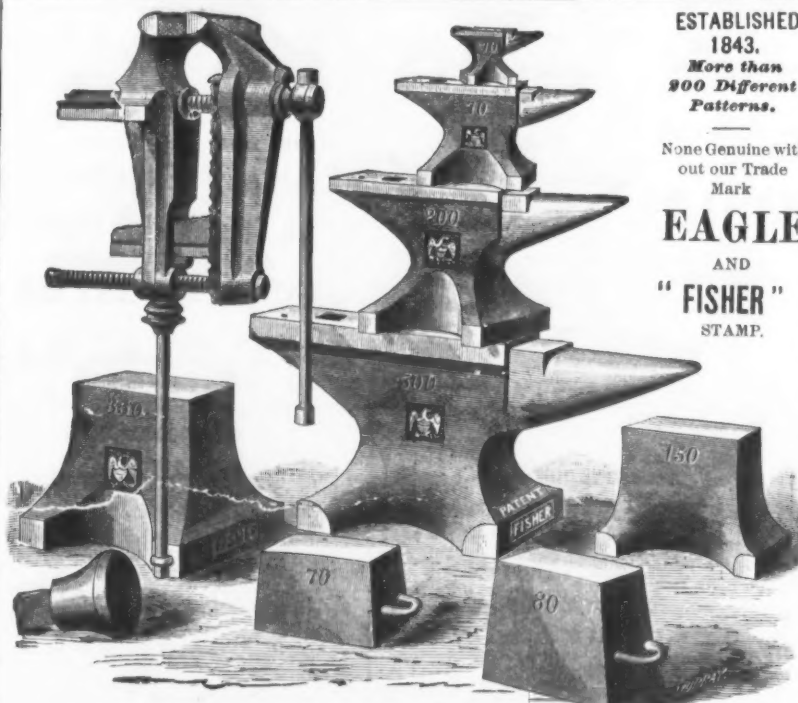
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of the coefficient. For this purpose the paper cylinder was removed and a small lever, M (see Fig. 2), was connected to the main indicating lever in such a manner that the motion of the end of the main lever was magnified five times at the end of the small lever. The end of the small lever was pointed, and when the machine was working this point was brought exactly opposite a fixed mark by putting weights into a scale-pan on the end of the main lever. The main lever was so overbalanced that under all circumstances some weight was required to be added to the scale-pan in order to bring the end of the small lever to the mark, even when the friction being greatest, the direction of motion of the journal tended most to depress it. The method of running in both directions and loading and unloading was followed, as before. The weights in the scale-pan being noted, the moment of friction was given by half the difference between the weight in the scale-pan when running in one direction and in the other. Experiment showed that the friction varied considerably with temperature. All the oil-bath experiments were therefore taken at a nearly uniform temperature of 90°; the variation above or below this temperature was never allowed to be more than 1½°.

III. Results of Experiments.—In the earlier experiments care was taken not to load the bearing up to seizing, in order that the condition of the brass might not be disturbed. In the later experiments the bearing was intentionally loaded up to seizing. Two sets of experiments were specially made for the purpose of ascertaining the greatest load which could be carried with rape and mineral oil in the oil bath. The greatest load

oil, subject to a pressure due to the load. The pressure in the middle of the brass was more than double the mean pressure. No doubt if there had been a number of pressure gauges connected to various parts of the brass, they would have shown that the pressure was highest in the middle and diminished to nothing toward the edges of the brass.

The experiments with ordinary lubrication were begun with a needle lubricator, the hole from which penetrated to the center of the brass. A groove in the middle of the brass, and parallel to the axis of the journal, extended nearly to the ends of the bearing for distributing the oil (see Figs. 5 and 7). It was found that with this arrangement the bearing would not run cool when loaded with only 100 pounds per square inch, and that not a drop of oil would go down, even when the needle lubricator was removed and the hole filled completely with oil, thus giving a head of 7 inches of oil to force it into the brass. It appeared as though the hole and groove, being in the center of pressure of the brass, allowed the supporting oil film to escape. This view was confirmed by the following experiment: The oil hole being filled up to the top, the weight was eased off the journal for an instant. This allowed the oil to sink down in the hole and lubricate the journal, but immediately the load was again allowed to press on the journal, the oil rose in the hole to its former level and the journal became dry, thus showing that this arrangement of hole and groove, instead of being a means of lubricating the journal, was a most effectual one for collecting and removing all oil from it. It should be mentioned that care was taken to chamfer the edges of the groove, so as to prevent any scrap-

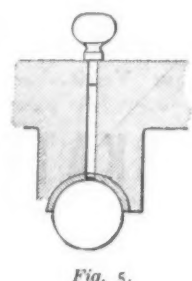


Fig. 5.

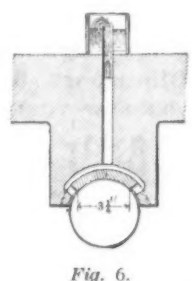


Fig. 6.

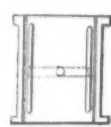


Fig. 8.



Fig. 9.

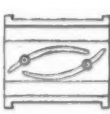


Fig. 12.

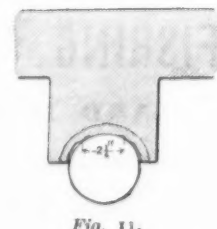


Fig. 11.

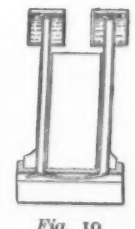


Fig. 10.

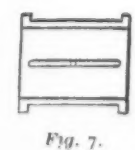


Fig. 7.

### FRICITION EXPERIMENTS.

carried with the rape oil was 573 pounds per square inch, and the greatest load carried with the mineral oil, 625 pounds. In both of these cases the experiment was repeated after the brass had been taken out and scraped up, but with no better result. The general results of the oil-bath experiments may be described as follows: The absolute friction—that is, the actual tangential force per square inch of bearing required to resist the tendency of the brass to go round with the journal—is nearly a constant under all loads, within ordinary working limits. Most certainly it does not increase in direct proportion to the load, as it should do, according to the ordinary theory of solid friction. The ordinary theory of solid friction is that it varies in direct proportion to the load; that it is independent of the extent of surface, and that it tends to diminish with an increase of velocity beyond a certain limit. The theory of liquid friction, on the other hand, is that it is independent of the pressure per unit of surface, is directly dependent on the extent of surface, and increases as the square of the velocity. The results of these experiments seem to show that the friction of a perfectly lubricated journal follows the laws of liquid friction much more closely than those of solid friction. They show that under these circumstances the friction is nearly independent of the pressure per square inch, and that it increases with the velocity, though at a rate not nearly so rapid as the square of the velocity. The experiments on friction at different temperatures indicate a very great diminution in the friction as the temperature rises. Thus, in the case of lard oil, taking a speed of 450 revolutions per minute, the coefficient of friction at a temperature of 120° is only one-third of what it was at a temperature of 60°.

A very interesting discovery was made when the oil-bath experiments were on the point of completion. The experiments being carried on were those on mineral oil, and the bearing having seized with 625 pounds per square inch, the brass was taken out and examined, and the experiment repeated. While the brass was out the opportunity was taken to drill a ½ inch hole for an ordinary lubricator through the cast-iron cap and the brass. On the machine being put together again and started with the oil in the bath, oil was observed to rise in the hole which had been drilled for the lubricator. The oil flowing over the top of the cap making a mess, an attempt was made to plug up the hole, first with a cork and then with a wooden plug. When the machine was started the plug was slowly forced out by the oil in a way which showed that it was acted on by a considerable pressure. A pressure gauge was screwed into the hole, and on the machine being started the pressure, as indicated by the gauge, gradually rose to above 200 pounds per square inch. The gauge was only graduated up to 200 pounds, and the pointer went beyond the highest graduation. The mean load on the horizontal section of the journal was only 100 pounds per square inch. This experiment showed conclusively that the brass was actually floating on a film of

ing action between them and the journal. As the center of the brass was obviously the wrong place to introduce the oil, it was resolved to try to introduce it at the sides. Accordingly, the center hole and groove were filled up and two grooves were made. These grooves were parallel to the axis of the journal, extending nearly to the ends of the brass, and were placed at equal distances on either side of the center; they formed boundaries to an arc of contact, the chord of which was 3¼ inches. (See Figs. 6 and 8.) With this arrangement of groove the lubrication appeared to be satisfactory, the oil going down into the journal and the bearing running cool. The bearing nevertheless seized with an actual load of only 380 pounds per square inch.

The arrangement of grooves was then altered to that used in locomotive axle-boxes (see Figs. 10, 11 and 12). The oil was introduced through two holes, one near each end of the brass, and each connected to a curved groove, the two curved grooves nearly inclosing an oval-shaped space in the center of the brass. At the same time the arc of contact was reduced till its chord was only 2½ inches. This brass refused to take its oil or run cool. It would sometimes run for a short time with an actual load of 178 pounds per square inch, but rapidly heated on the slightest increase of the load. The brass having been a good deal cut about by altering and filling up grooves, it was considered desirable to have a new brass, and one was accordingly obtained. The grooves being made exactly the same as in the last experiment with the old one, this brass seized with an actual load of only about 200 pounds per square inch. The oil-box was completely cut away so as to allow a freer current of air round the bearing, and the lubricator pipes were soldered into the brass. The wicks were taken out of the lubricators and the lubricators filled full of oil, by which means oil was supplied to the brass under a full head of 9 inches, and yet the oil refused to go down, and the under side of the journal felt perfectly dry to the hand, and speedily heated with a load of only 200 pounds per square inch.

The fact that this arrangement of grooves, which is found to answer in the axles of railway vehicles, was found to be perfectly useless in this apparatus can only be accounted for by the fact that a railway axle has a continual end play while running, which prevents the brass becoming the perfect oil-tight fit which it became in this apparatus. The attempts to make this arrangement of lubrication answer were not abandoned until after repeated trials. It now became clear that there was no use in trying to introduce the oil directly to the part of the brass against which the pressure acted, and that the only way to proceed was to oil the lower side of the journal, and trust to the oil being carried around by the journal to the seat of the pressure. The grooves and holes in the brass were accordingly filled up and an oily pad, contained in a tin box full of rape oil, was placed under the journal, so that the journal rubbed against it in turn-



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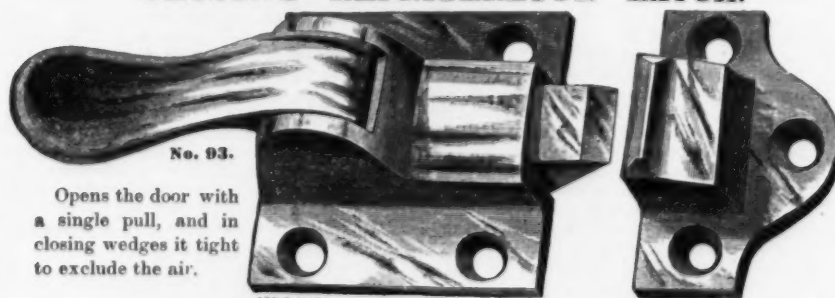
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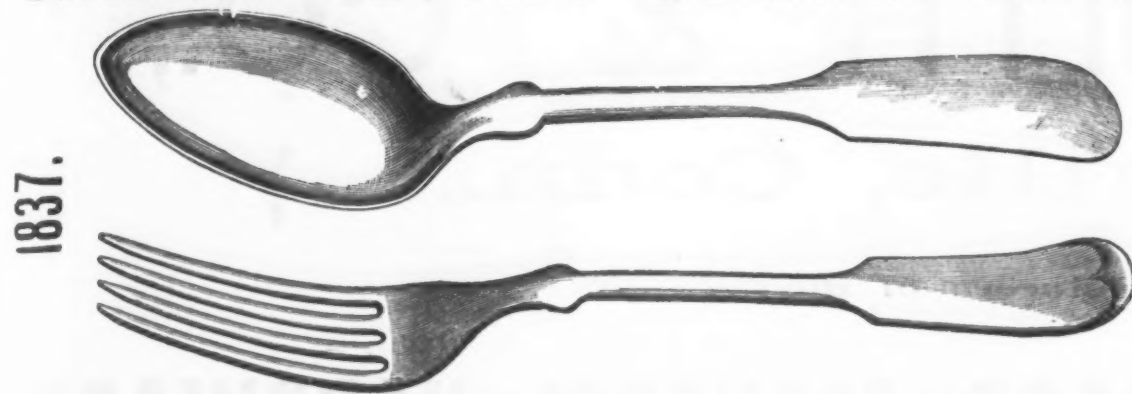
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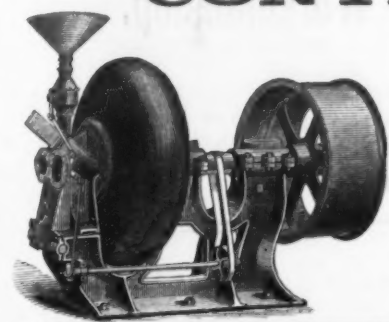
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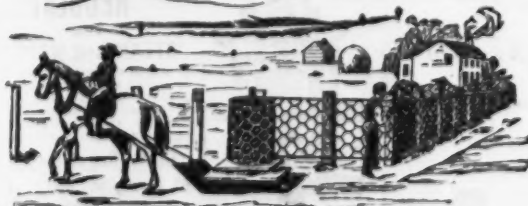
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ing. The pad was only supplied with oil by capillary attraction from the oil in the box, and the supply of oil to the journal was thus very small; the oiliness, in fact, was only just perceptible to the touch, but it was evenly and uniformly distributed over the whole journal. The bearing fairly carried 551 pounds per square inch, and three observations were obtained with 528 pounds, but the bearing was on the point of seizing, and did seize after running a few minutes with this load. It will be observed that in this instance the bearing seized with very nearly the same load as it did in the oil-bath experiment with rape oil. These experiments with the oily pad show a nearer approach to the ordinarily received laws of solid friction than any of the others. The coefficient is approximately constant, and may be stated as about  $\frac{1}{15}$  on an average. There does not in this case appear to be any well-defined variation of friction with variations of speed, according to any regular law. The results of the experiments with the rape oil, fed by a syphon lubricator to side grooves, follow nearly the same law as the results obtained from the oil-bath experiments, as far as the approximate constancy of the moment of friction is concerned, but the amount of the friction is about four times the amount in the oil bath.

The results of the experiments on what is called ordinary lubrication—that is, lubrication by means other than that of the oil bath—were not, as a subject, sufficiently regular to make them worthy of record. Indeed, the results, generally speaking, were so uncertain and irregular that they may be summed up in a few words. The friction depends on the quantity and uniformity of distribution of the oil, and may be anything between the oil-bath results and seizing, according to the perfection or imperfection of the lubrication. The lubrication may be so small as to give a coefficient of  $\frac{1}{15}$ , but it appeared as though it could not be diminished and the friction increased much beyond this point without imminent risk of heating and seizing. The oil bath probably represents the most perfect possible lubrication and the limit beyond which friction cannot be reduced by lubrication; and the experiments show that with speeds of from 100 feet to 200 feet per minute, by properly proportioning the bearing surface to the load, it is possible to reduce the coefficient of friction as low as  $\frac{1}{15}$ . A coefficient of  $\frac{1}{15}$  is easily attainable, and probably is frequently attained, in ordinary engine bearings in which the direction of the force is rapidly alternating and the oil given an opportunity to get between the surfaces, while the duration of the force in one direction is not sufficient to allow time for the oil film to be squeezed out. The extent to which the friction depends on the quantity of the lubrication is shown in a remarkable manner in Table I, which proves that the lubrication can be so diminished that the friction is even times greater than it was in the oil bath, and yet that the bearing will run without seizing.

Observations of the behavior of the apparatus gave reasons to believe that with perfect lubrication the speed of minimum friction was from 100 to 150 feet per minute, and that this speed of minimum friction tended to be higher with an increase of load, and also with less perfect lubrication. By the speed of minimum friction is meant that speed in approaching which, from rest, the friction diminishes, and above which the friction increases.

TABLE I.—Comparison of the Friction with the Different Methods of Lubrication, Under as Nearly as Possible the Same Circumstances.—Lubricant, Rape Oil; Speed, 150 Revolutions per Minute.

	Actual load, lbs.	Coef. of friction.	Comparison, active friction.
Oil bath	253	0.0135	1.00
Syphon lubricator	252	0.00829	7.05
Pad under journal	272	0.00000	6.48

TABLE II.—Comparison of the Friction with the Various Lubricants Tried, Under as Nearly as Possible the Same Circumstances, Temperature, 90°; Lubrication by Oil Bath.

Lubricant.	Mean resistance, lbs.
Sperm oil	0.464
Rape oil	0.512
Mineral oil	0.623
Lard oil	0.652
Hive oil	0.654
Mineral grease	1.048

N. B.—The above figures are the means of the actual frictional resistances at the surface of the journal per square inch of bearing at a speed of 300 revolutions per minute, with all the nominal loads from 100 pounds per square inch up to 370 pounds per square inch. They also represent the relative thickness or body of the various oils, and also in their order, though perhaps not exactly in their numerical proportions, their relative weight-carrying power. Thus, sperm oil, which has the highest lubricating power, has the least weight-carrying power, and, though the best oil for light loads, would be inferior to the thicker oil if heavy pressure or high temperatures were to be encountered.

The International Forestry Exhibition.—We have received the prospectus and classified list of the Forestry Exhibition to be held in Edinburgh during the coming summer. This exhibition promises to be of great interest. It relates not alone to forestry proper, but will include everything pertaining to wood growing and wood manufacture, including all forms of wood cutting and sawing machinery, wood-working tools and manufactures of wood in every form, besides wood products, such as gums, resins, flax, wood oils, charcoal, and, in fact, everything included under the broadest and most liberal classification. The exhibition will be open to builders from all countries, and its intended scope is large enough to give it an unusual popular interest. The American exhibits in every line pertaining to forestry or wood-working, or to manufactures of wood, will be welcomed. Mr. Charles O. Le Count, of 29 Chambers street, New York, correspondent of Elgin & Gilchrist, American factors at Glasgow, will furnish all information to intending exhibitors, and authorize us to tender his services in forwarding and arranging for the proper exhibition or care of any articles or tools sent from this country.

Mr. Charles F. Curwen, of the Salem Foundry and Machine Shop, Salem, Mass., sends us a very neat 1884 calendar. The

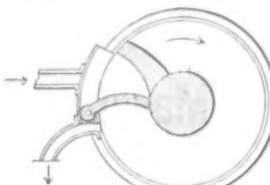
design is a pretty one, engraved by John A. Lowell & Co., and bears the inscription, "Our Compliments and Wishes for a Prosperous Year." Between the leaves containing the months of the year are brief references to the various goods manufactured by the concern.

### The Inventions of Watt.\*

EDWARD A. COWPER.

(Concluded.)

There are two very striking inventions of steam engines altogether different from the steam engines previously spoken of, and acting in a different manner. One is a rotary engine, Fig. 17, and the other a semi-rotary engine, Figs. 18 and 19. In the rotary engine there is a piston, fixed as an arm, in a radial line to the shaft to be turned, and the cylinder of the engine fits the piston in its revolution, there being at one point a flap-valve, hinged to the inside of the cylinder, while its other end rests on the shaft, so as to form a cylinder bottom, or point d'appui for the steam to act against when acting also



The Inventions of Watt.—Fig. 17.—Rotary Engine.

on the piston. This flap-valve is at a slight angle to a radial line, so that when the piston comes round it can leave it up so as to get past. This is about the simplest form of rotary engine that can be conceived, and has probably been reinvented 50 times since 1782.

The semi-rotary engine, Figs. 18 and 19, has likewise a piston fixed in a radial line to the shaft to be turned, and the cylinder fits the piston as it moves backward and forward through a considerable arc of the circle; fixed inside the cylinder at one part is a

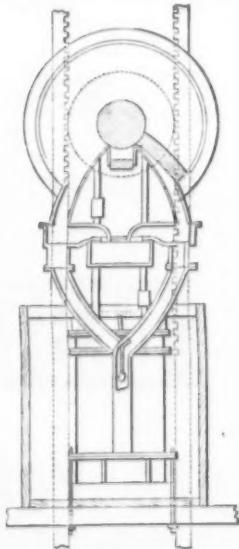


Fig. 18.—Front View of Semi-Rotary Engine.

stationary stop or cylinder bottom, for the steam to act against either way, as it acts against the piston in either one direction or the other. It was intended to let the reciprocating shaft act with a spur wheel on two racks attached to the pump-rods. There is an unfinished model of this engine in the "Watt Room" at Heathfield Hall, which the author has examined; no doubt this was partly made by Mr. Watt's own hands. In a letter of Mr. Watt's, dated September 27,

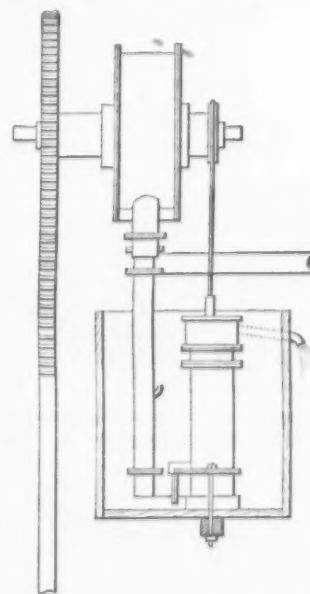


Fig. 19.—Side Elevation of Semi-Rotary Engine.

1782, he speaks of this model having been made, so far, in 1765 or 1766.

It remains now to give some description of the more important articles found in the "Watt Room" at Heathfield Hall, the residence of our member, Mr. George Tangye, who, as before mentioned, has kindly photographed many articles for the institution. The room is about 20 feet by 16 feet 6 inches in size, and really is a good attic, and nothing more, with one long, low window only 5 feet 4 inches from the top to the floor, so that it was a bad light for any machine a few feet from the window, and it is a wonder that Mr. Watt did not devote a better room to his purposes. There are numerous shelves with drugs and parcels on them.

\* Paper read before the Institute of Mechanical Engineers at Birmingham, England.

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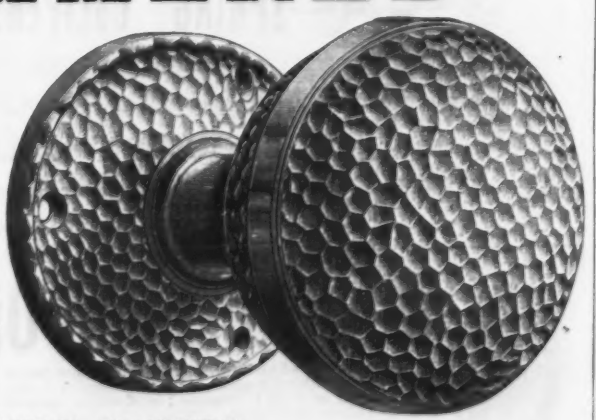
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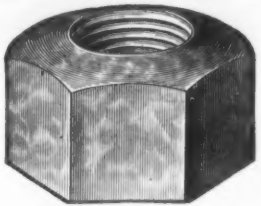
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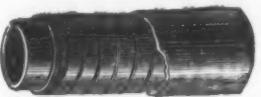




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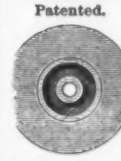
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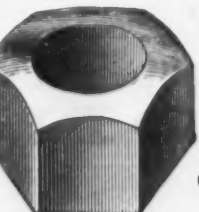
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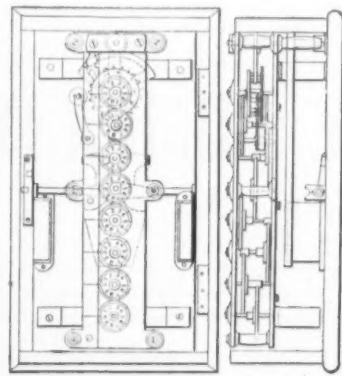
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and nests of small drawers with tools in them, some of them very excellent tools, and his small lathe and bench stand at the window, with his tools about, and his old leather apron on the vise, and his center-punch tied with a piece of catgut to the vise, to save him the trouble of looking for it or picking it up. There are now a number of busts on a bench in the room, and some marble and alabaster for working on. At the fireplace there is his old frying-pan and his Dutch oven or "hastener," and outside the door, on the landing, a little shelf on which, it is presumed, his meals were placed.

Besides these things there are two large machines for sculpturing marble, alabaster or wood, and a few smaller half-finished models, such as the semi-rotary engine just named, and a "counter" for counting and recording the number of strokes that an engine makes. This is constructed on the intermittent principle—that is to say, the first wheel has ten teeth, and when it has received nine impulses from nine strokes having been made, the tenth stroke not only turns the first wheel one-tenth, but this wheel, owing to its having a raised tooth at that particular place, turns the next wheel one-tenth also, thus scoring one tooth on the second wheel, and so representing ten strokes, and so on throughout the series, so



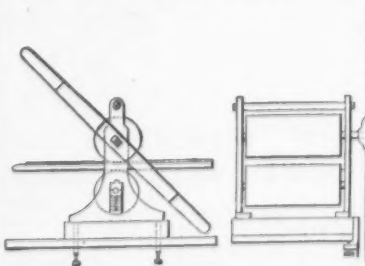
The Inventions of Watt.—Fig. 20.—Engine Counter at the South Kensington Museum, England.

that when 999 strokes have taken place, the next stroke, in fact, moves all three wheels, which then show 000, and the fourth wheel goes one tooth suddenly, and thus shows 1000.

There is a modification of this counter, Fig. 20, at the South Kensington Museum, in which there are seven wheels and pinions, all geared together, the wheels having 100 teeth and the pinions 10 teeth, so that all the wheels are always moving when one moves. This is a very safe instrument, but is not quite so clear to read. It is believed that these are the first "counters" that were ever made—at all events to go to millions, as these do.

An exceedingly simple but handy plan of blocking-up anything to a given height is shown in Fig. 24, being, in fact, only a pair of "folding wedges," but with a number of notches into which a pin can drop, and so keep them from sliding when at almost any exact height. In this room the author found a large number of little slips of copying paper, with various receipts for making copying ink, and in one corner of the room a small "letter-copying screw press," that would take in such slips conveniently (Fig. 23), and the screw was only of wood, but powerful enough for the light work it had to do. This is shown in Watt's 1780 patent, together with his "letter-copying roller press" (Figs. 21 and 22), of which there is also an example at South Kensington, together with his old desk, in which he had a pair of small rollers fitted for the same purpose. These two last belong to Mrs. Bennett Woodcroft. The drugs on the shelves were many of them for the purpose of making the "copying-ink powders" that Watt used to sell at ninepence a packet, and of which there are some dozens now at Heathfield Hall. It is believed that he sold these on his own account.

The next machine to be noticed is a very remarkable one, when we consider the date at which it was made. It is a machine for



Figs. 21 and 22.—Letter-Copying Roller Press.

sculpturing or copying a *bas-relief* of the same size as the original. The machine consists, first, of an ordinary lathe, with treadle and fly-wheel to supply the motive power, and, secondly, of two tall uprights about 7 feet high, carrying at the top a slide on a strong horizontal bar, the slide being capable of motion horizontally, either at a slow or quick speed. Then, hinged to this slide, is a light square frame of metal, and, at the outer edge of this, another light square frame of metal is hinged, so that the lower edge of such frame is capable of motion up and down, or in and out, like an elbow joint, and horizontally when the top slide is moved.

The weight of these frames is balanced by levers and balance weights and chains above, and the lower edge of the second frame is furnished with a "feeler" or "guide" to traverse over the original model, and a "drill" driven at a high speed by a light cord to cut the work or copy, so that by handling the feeler carefully and tracing over the original in all directions, a piece of marble or alabaster or wood, placed in the machine alongside of the original, is cut to a perfect copy by the machine without fear of any mistake, and without any special skill on the part of the operator. The slow motion to the slide above, carrying the frames and "feeler" and "drill," is worked

by a convenient handle and tangent screw when cutting, and the quick motion can be thrown into gear with the lathe-wheel to run back. The quick motion has a coarse traversing screw, having a nut in halves that can be closed or opened; and the slow motion has a fine-threaded screw with a similar nut, so that it also can be thrown into gear or released. A handkerchief is wrapped around a part of one frame, in such position that one could put one's head against

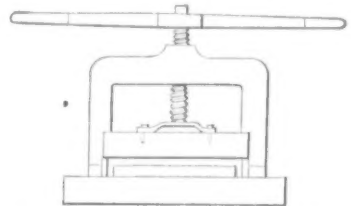


Fig. 23.—Letter-Copying Screw Press.

it, to push it up off the work at pleasure, besides moving it by hand. There is a noticeable feature in the frames above mentioned, and that is, that in order to prevent their springing or going "winding," they are practically formed into "solids" by the erection of the outlines of a pyramid on each; this gives extreme stiffness to them, at the expense of but very little weight. This the author considers an extremely ingenious method of preventing a framing from going "winding," and one that he has not seen before.

After searching the room over, two specimens of work were found, one a finished original *bas-relief*, and the other the unfinished copy of it. Both the original and the copy can be mounted in their places in the machine, and be turned precisely together by a pinion gearing into the two wheels on the mandrels of the carriages on which the articles are placed, so that "undercutting" could be properly accomplished, as well as straight cutting into the work by the "drills."

The drills, circular cutters and other cutting tools are excellent, some being formed for roughing out, apparently, and made to cut in steps—i.e., to take several light cuts—and some in the forms of globes with the whole surface formed into numerous cutting edges, so that it was a cutting globe, so to speak, and could go anywhere, as it would cut in any direction.

There was also a sculpturing machine for making a copy of a reduced size. After searching the room thoroughly, two "masks" or half-faces were found, the one eight times the size of the other, and the smaller one undoubtedly executed in this machine. The machine consists, firstly, of a lathe bed, with fly-wheel and treadle for obtaining the motive power for driving the drill; secondly, of a stout hollow tube forming a long lever, fulcrumed at one end on a "universal joint," so that the other end can be moved in any direction about the center. This lever carries a "feeler" or blunt point near



Fig. 24.—Folding Wedges for Blocking-Up Anything to a Given Height.

its outer end, and a "drill" near the fulcrum, so that, whatever motion the "feeler" has, the "drill" has, say, one-eighth part as much. Thus, if a bust or mask (in this case a plaster cast) is placed on the slide provided for it under the "feeler," and such "feeler" is carefully traced all over it, the "drill" will cut a piece of material placed under it, on the slide provided for it, to the same form, except that it will be one-eighth the size of the original. The lever is balanced.

The slides above named slide on the bed of the lathe, and are moved by a "pentagraph," or arrangement of levers, to give one-eighth as much motion to the work to be cut as to the original, so that every dimension shall be in proportion. A further motion is provided for turning round the original and the copy, as is sometimes necessary when undercutting a *bas-relief*, and, of course, when copying the round figure. One example, and one only, was found of the round figure, viz., an unfinished head and bust in wood—so small that no doubt it was done in this machine from a larger original. It would appear that the machines just described were used by James Watt probably as a mere amusement for his leisure during the latter days of his life, for they do not appear to have been patented by him or in any way brought before the public. It is to be hoped that in the pursuit of this hobby he found agreeable relaxation and relief after the laborious life which he had long led.

In conclusion, the author would draw attention to the general effects produced by the inventions of James Watt:

1. In 1769 there were many Newcomen engines at work pumping (in fact, Watt's attention was first drawn to steam engines by having to repair a model of a Newcomen engine), and the effect of his invention was to work pumping engines more economically and quickly.

2. In 1781 he produced rotative power for driving factories, obtaining it, in a manner, by having a heavy balance-weight to act one way while the steam acted the other way; however, the obtaining rotative motion by steam was an enormous advantage, far greater in its effect, in the author's opinion, than the improvement in the pumping engine.

3. The crowning invention of 1782 made the steam engine the one useful motive power by making it double-acting, and fit to drive cotton mills, flour mills and all other machinery requiring regular rotative motion. The general effect of the invention on the manufactures of the world, and first, of course, on those of this country, is so widespread that it cannot be estimated; it has cheapened production to a marvelous extent, has in very many instances been the means of bringing new manufactures into existence, and has immensely increased the intercourse between nations, by developing from fire and water as many tame giants as we require to do our work.



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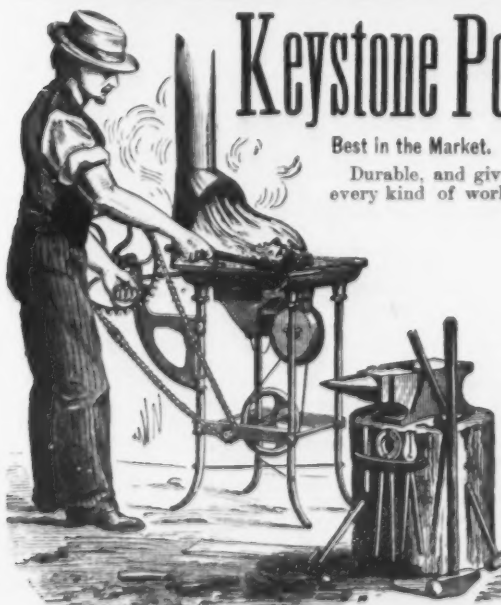
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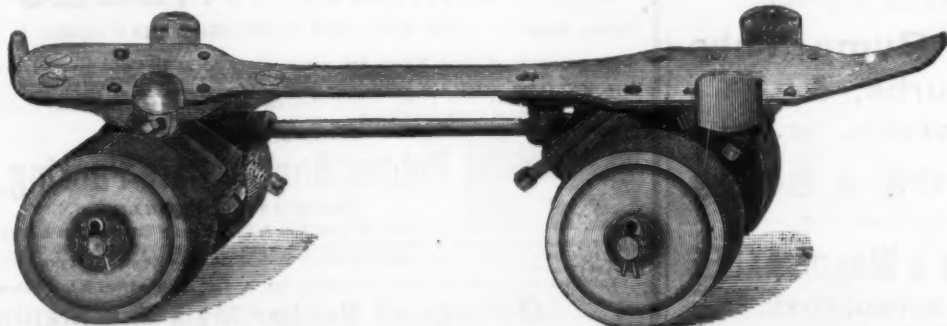
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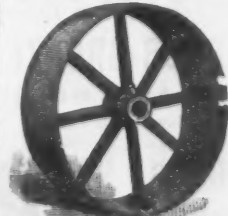
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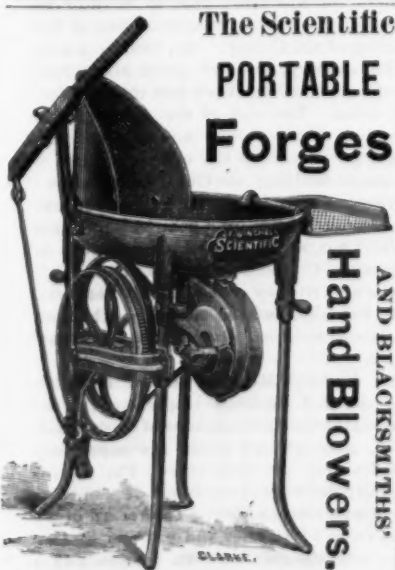
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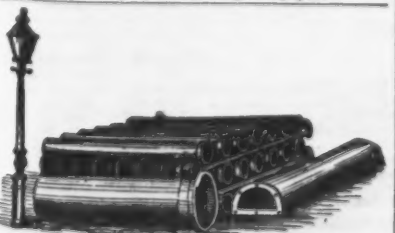
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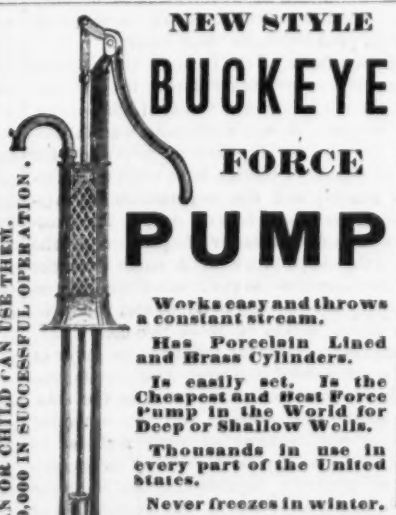
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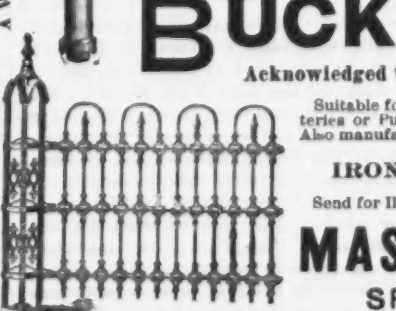
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## Production of Pig Iron in the United States in 1882 and 1883.

Statistics Collected from the Manu-  
facturers by the American Iron and Steel  
Association.

PRODUCTION OF ALL KINDS OF PIG IRON IN 1882 AND 1883, BY STATES.

Total Production of Pig Iron, in Tons of 2000 lbs.

States.	1882.	1883.
Maine.....	4,170	4,400
Vermont.....	1,210	1,210
Massachusetts.....	10,335	10,760
Connecticut.....	34,342	39,970
New York.....	150,156	151,964
New Jersey.....	170,008	170,008
Pennsylvania.....	2,449,256	2,688,891
Maryland.....	54,824	49,173
Virginia.....	87,731	152,907
North Carolina.....	1,150	1,150
Georgia.....	42,440	45,354
Alabama.....	112,765	172,465
Texas.....	1,321	2,351
West Virginia.....	73,220	88,308
Kentucky.....	60,522	64,629
Tennessee.....	137,002	138,293
Indiana.....	688,900	679,643
Illinois.....	10,000	9,900
Michigan.....	360,407	237,657
Wisconsin.....	210,195	173,185
Minnesota.....	85,859	51,538
Missouri.....	113,644	103,296
Utah.....	8,136	8,000
Colorado.....	37	37
Oregon.....	33,718	34,680
California.....	6,750	7,000
Washington Territory.....	987	5,327
Total.....	5,178,122	5,146,972

Production of Charcoal Pig Iron.

States.	1882.	1883.
Maine.....	4,100	4,400
Vermont.....	1,210	1,210
Massachusetts.....	10,335	10,760
Connecticut.....	34,342	39,970
New York.....	30,716	25,610
Pennsylvania.....	49,975	38,315
Maryland.....	28,277	28,807
Virginia.....	38,133	16,879
North Carolina.....	1,150	1,150
Georgia.....	15,565	13,045
Alabama.....	55,541	57,365
Texas.....	1,321	2,351
West Virginia.....	17,168	15,981
Kentucky.....	37,611	35,299
Tennessee.....	58,654	40,538
Indiana.....	210,195	173,185
Michigan.....	35,369	39,349
Wisconsin.....	54,327	34,112
Minnesota.....	8,136	8,000
Missouri.....	57	57
Utah.....	6,750	7,000
Oregon.....	987	5,327
California.....	987	5,327
Washington Territory.....	987	5,327
Total.....	697,906	571,736

Production of Bituminous Coal and Coke Pig Iron.

States.	1882.	1883.
Pennsylvania.....	945,635	1,184,108
Maryland.....	1,275	1,275
Virginia.....	61,598	136,028
Georgia.....	26,875	32,819
Alabama.....	57,224	115,080
West Virginia.....	73,220	88,308
Kentucky.....	40,648	38,315
Tennessee.....	96,991	98,664
Ohio.....	640,246	639,115
Indiana.....	10,000	9,900
Michigan.....	360,407	237,657
Wisconsin.....	20,490	12,544
Minnesota.....	59,317	60,124
Missouri.....	29,718	24,680
Colorado.....	29,718	24,680
Total.....	2,438,078	2,680,650

Production of Anthracite Pig Iron.

States.	1882.	1883.
New York.....	385,440	306,284
New Jersey.....	170,008	170,008
Pennsylvania.....	1,453,646	1,416,498
Maryland.....	96,247	94,071
Total.....	2,042,138	1,885,596

PRODUCTION OF PIG IRON STATISTICS FOR 1882 AND 1883.

Production According to Fuel Used, in Tons of 2000 lbs.

Fuel used.

Anthracite..... 2,042,138 1,885,596

Charcoal..... 697,906 571,736

Bituminous..... 2,438,078 2,680,650

Total..... 5,178,122 5,146,972

Production of Pig Iron in Certain Districts, in Tons of 2000 lbs.

1882. 1883.

Pennsylvania..... 696,338 575,187

Lehigh Valley..... 342,701 337,431

Schuylkill Valley..... 201,367 160,629

Upper Susquehanna Valley..... 300,240 337,419

Lower Susquehanna Valley..... 304,078 290,069

Allegheny County..... 328,840 592,475

Miscellaneous coke..... 322,717 301,564

Charcoal..... 49,975 38,315

Ohio..... 77,364 82,455

Hanging Rock coke..... 228,478 244,295

Mahoning Valley..... 78,770 48,439

Hocking Valley..... 225,634 228,566

Hanging Rock charcoal..... 55,546 58,134

Miscellaneous charcoal..... 3,108 2,304

STOCKS OF ALL KINDS OF PIG IRON UNSOLD AT THE CLOSE OF 1882 AND 1883.

Total Stocks of Unsold Pig Iron, in Tons of 2000 lbs.

Jan. 1, 1882. July 1, 1882. Jan. 1, 1883.

New England..... 9,860 13,222 12,437

New York..... 37,758 78,173 65,801

New Jersey..... 26,974 26,974 26,974

Pennsylvania..... 150,258 238,576 185,904

Maryland..... 7,320 10,899 10,899

Va., N. C., Ga. and Tex. 25,064 39,604 39,601

Alabama..... 30,068 14,402 9,531

West Virginia..... 4,296 5,517 1,900

Kentucky..... 11,186 7,056 8,216

Tennessee..... 13,992 27,546 30,047

Ohio..... 87,253 66,141 79,136

Michigan and Indiana..... 29,573 34,542 36,406

Illinois..... 14,401 14,401 14,401

Wisconsin and Minn. 5,501 15,594 6,340

Missouri..... 14,223 17,576 21,641

Col. and Pacific States..... 896 896 896

Total..... 439,694 592,030 535,800

Stocks of Unsold Anthracite Pig Iron.

Jan. 1, 1882. July 1, 1882. Jan. 1, 1883.

New York..... 25,278 25,278 25,278

New Jersey..... 19,178 26,974 26,974

Pennsylvania..... 68,106 130,215 96,211

Maryland..... 1,737 3,304 4,500

Total..... 102,299 286,469 178,980

Stocks of Unsold Charcoal Pig Iron, in Tons of 2000 lbs.

Jan. 1, 1882. July 1, 1882. Jan. 1, 1883.

New England..... 9,860 13,222 12,437

New York..... 12,520 16,529 17,307

Pennsylvania..... 10,941 8,050 11,336

Maryland..... 5,548 3,043 6,399

Va., N. C., Ga. & Tex. 15,229 14,434 14,434

Alabama..... 16,022 11,875 6,731

Kentucky..... 7,374 6,048 6,916

Tennessee..... 10,460 12,289 14,061

Ohio..... 25,314 21,498 22,291

Michigan and Indiana..... 37,073 33,570 35,678

Wisconsin and Minn. 5,801 7,608 6,340

Missouri..... 12,223 12,174 17,801

Col. and Pacific States..... 896 896 896

Total..... 165,239 163,246 183,978

Stocks of Unsold Bituminous Coal and Coke Pig Iron, in Tons of 2000 lbs.

Jan. 1, 1882. July 1, 1882. Jan. 1, 1883.

Pennsylvania..... 79,511 109,711 85,257

Maryland..... 1,275 1,275 1,275

Va., N. C., Ga. & Tex. 8,375 8,375 8,375

Alabama..... 3,446 2,587 2,800

West Virginia..... 4,296 5,517 1,900

Kentucky..... 3,922 1,006 1,006

Tennessee..... 2,982 15,226 11,886

Ohio..... 58,590 48,153 47,915

Michigan and Indiana..... 2,500 672 727

Illinois..... 896 14,401 14,401

Wisconsin and Minn. 1,800 7,960 8,700

Missouri..... 1,800 5,400 5,700

Total..... 157,196 219,631 171,808

Stocks According to Fuel Used.

	1882.	1883.
Bituminous.....	157,196	219,631
Anthracite.....	107,359	219,143
Charcoal.....	165,239	163,246
Total.....	429,694	592,030

Stocks of Pig Iron in Certain Districts.

Pennsylvania.

Lehigh Val. anthracite..... 24,999 58,500 50,600

Schuylkill V. anthracite..... 24,029 41,837 25,449

Upper Sus. anthracite..... 11,173 2,454 8,339



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AND  
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New York, Thursday, February 14, 1884.

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in the United States and Canada.....\$4.75 or 75s  
in Great Britain and Ireland.....3.50 or 75s  
in other countries.....4.75 or 75s

Our Tariff History.

In connection with the tariff-reform move-  
ment and the probable action of the repre-  
sentatives of the people from different sec-  
tions of the country upon tariff measures in  
Congress, it is of interest to note the votes  
upon the tariff bills since the foundation of  
the present form of government as an indi-  
cation of the state of public sentiment.

For convenience of reference and to avoid  
repetition the country is divided into sec-  
tions, as follows:

New England States.—Maine, New Hamp-  
shire, Vermont, Massachusetts, Connecticut  
and Rhode Island.

Middle States.—New York, New Jersey,  
Pennsylvania, Delaware, Maryland and West  
Virginia.

Western and Northwestern States.—Ohio,  
Indiana, Illinois, Michigan, Wisconsin, Min-  
nesota, Iowa, Missouri, Kansas, Nebraska  
and Colorado.

Southern and Southwestern States.—Vir-  
ginia, North Carolina, South Carolina,  
Georgia, Alabama, Mississippi, Florida,  
Louisiana, Texas, Arkansas, Kentucky and  
Tennessee.

Pacific States.—California, Oregon and  
Nevada.

By way of illustration whether the tariff  
was favorable or unfavorable, the duties on  
some leading item of iron are taken as the  
test. The figures are the votes in the House  
of Representatives on the tariff acts named.

The first tariff act was passed on July 4,  
1790, by the First Congress, but no vote is  
recorded. The duties, however, on iron,  
cut, hoop, slit and rolled, were 7½ per cent.;  
nails, 1 cent per pound; spikes, cut iron, 1  
cent per pound; steel, unwrought, 50 cents  
per cwt., and iron and steel wire free. Pig  
iron is not mentioned.

Under the tariff acts of 1790 and 1791, the  
duties on the above articles remained the  
same except the duty on unwrought steel,  
which was increased to 75 cents per cwt. The  
New England States, except Rhode Island,  
were divided, giving 5 votes for and 9  
votes against the act of 1790. These same  
States, including Rhode Island, on the act  
of 1791, which fixed an increased duty on  
steel, cast a solid vote of 17 for the act. The  
Middle States, except, of course, West Vir-  
ginia, were divided, casting 17 votes for  
and 3 votes (New York, 1, and Maryland, 2)  
against the act of 1790, and 13 votes for and  
8 votes (New York, 2; Pennsylvania, 3, and  
Maryland, 3) against the act of 1791. The  
Southern States, Virginia, North and South  
Carolina and Georgia, gave 17 votes for  
and 1 against the act of 1790, and 5 votes

for and 13 against the act of 1791. The  
Northwestern, Southwestern and Pacific  
States were not in existence. Thus we find  
the New England and Middle States sustain-  
ing increase of duties, and the South oppos-  
ing such a step.

Under the acts of 1792, '94, '95 and '97,  
1800, '4, '7, '8, '12, '13, '15, and February 5,  
1816, there was a steady increase of rates of  
duties from 10 per cent. on iron, as above;  
2 cents per pound on nails and spikes, and  
\$1 per cwt. on wrought steel, in the act of  
1792, to 2 cents per pound on iron, 4 cents  
per pound on nails and spikes, and \$2 per  
cwt. on steel in the act of 1816. Iron and  
steel wire in the last-named act, for the first  
time were made dutiable at 35 per cent. Pig  
iron still remained undutiable. The act of  
April 27, 1816, took up the tariff question in  
more detail, and introduced many items  
hitherto unknown to the schedules. Iron,  
old and scrap, were not mentioned, but pig  
iron was inserted at 50 cents per cwt.; cut,  
hoop, slit and rolled iron at \$2.50 per cwt.;  
nails, iron and cut, at 3 cents and 4 cents a  
pound; steel, unwrought, \$1 per cwt. (a re-  
duction), and coal at 5 cents a bushel. The  
votes on the principal acts enumerated stood  
as follows:

States.	1792.		1804.		Apr. 27, '16	
	yea	nay	yea	nay	yea	nay
New Eng'd, except Maine.....	14	2	23	none	17	10
Middle.....	16	5	34	none	44	10
Western (Ohio).....	1	1	none	4	none	
Southern and S. W., including in 1804 Ky. and Tenn., and in 1816 La.....	7	18	40	none	23	34

The tariff of 1804, which was adopted  
without a dissenting vote, re-enacted the in-  
creased duties of the tariff of 1797, viz.:  
Iron, 1 cent per pound; nails and spikes, 2  
cents per pound, and steel, \$1 per cwt. In  
the act of April 27, 1816, the duties on  
many articles had reached their maximum  
up to that date, and on other items there was  
a reduction. The West—then Ohio—cast  
her first and solid vote for the tariff. There  
was a marked division of tariff sentiment in  
the New England and Middle States—in the  
latter New York contributing 2, Pennsylv-  
ania 3 and Maryland 5 of the opposition  
votes. The Southern States cast a majority  
against high tariff. In this section South  
Carolina, Kentucky and Tennessee alone  
cast a majority of their delegations favor-  
able to the higher rates. North Carolina  
cast her 11 votes in a body, and Virginia 7  
out of 13 votes against the act of 1816.

After the act of April 27, 1816, came the  
tariffs acts of 1818, 1819, 1824, 1825, 1828  
(May 19 and May 24), 1830 (May 20 and May  
29), 1832 (July 13 and 14); and under the  
operation of the act of March 2, 1833,  
the acts of 1836, 1841, and as in force  
June 30, 1842, and the act of August  
30, 1842 and 1846. The votes on the  
acts of 1832, 1842 and 1846, all notable  
acts in the history of tariff legislation, were  
as follows:

States.	1832.		1842.		1846.	
	yea	nay	yea	nay	yea	nay
New England.....	17	17	28	7	9	19
Middle.....	52	18	54	10	18	44
Western and N. W.....	18	none	13	13	29	10
Southern and S. W.....	45	30	10	69	58	30

Under these acts, iron—old and scrap—  
was reduced from \$12.50 per ton in 1832 to  
\$10 a ton in 1842, and fixed at 30 per cent. in  
1846. Pig iron, 62½ cents per cwt. in 1830,  
was reduced to 50 cents per cwt. in 1832,  
\$9 a ton in 1842, and 30 per cent. in 1846.  
Cut, hoop, slit and rolled iron, 3 cents a pound  
in 1832, was reduced to 2½ cents a pound in  
1842, and 30 per cent. in 1846. Iron for  
railroads, 1 cent per pound in 1832, was 2  
per cent. in 1842, and not specified in 1846,  
and steel, in 1832 \$1.50 per cwt., was free in  
1842, except in bars, \$2.50 per cwt., and in  
1846 it was dutiable at 20 per cent. Coal, 6  
cents a bushel in 1832, and \$1.75 per ton in  
1842, was placed on the free list in 1846. It  
will be observed by the votes that the New  
England and Middle States sustained the  
protective tariff of 1842 by an overwhelm-  
ing majority, while the Western States were  
a tie, and the Southern States were six to  
one against protection. In the case of the  
low tariff of 1846, we find the New England  
and Middle States voting about two to one  
against the bill, and the West and South  
about the same proportion for it.

In the progress of tariff legislation we find  
the act of 1846 followed by the acts of 1857;  
1861, March 2, August 5 and December 24;  
1862; 1863; 1864; 1869; 1866, March 16,  
May 16, June 1 and July 25; 1867, March 2,  
22, 25, 26 and 29; 1868, February 3 and  
July 20; 1869, February 19 and 24; 1870,  
July 14 and December 22; 1872, May 1 and  
June 6, 1874; 1875, February 8 and March  
3; 1879; 1880; 1882, May 6 and Decem-  
ber 23, and the act of March 3, 1883. The  
following were the votes on the tariffs of  
1857, 1861, 1866, 1875 and 1883, indicating  
the state of public sentiment in the sections  
named:

States.	1857.		1861, Mar.		1866.	
	yea	nay	yea	nay	yea	nay
N. Eng. States.....	18	9	23	none	23	none
Middle States.....	24	28	44	9	40	14
Western & N. W. States.....	14	33	28	12	27	29
Southern & S. W. States.....	60	none	7	21	1	6
Pacific States.....	2	none	none	1	4	none

States.	1872.		1883.	
	yea	nay	yea	nay
New England States.....	17	6	24	1
Middle States.....	30	28	49	32
Western & N. W. States.....	53	18	61	33
Southern & S. W. States.....	46	8	15	57
Pacific States.....	3	1	3	3

The tariff act of 1857, which made reduc-  
tions in the duties in certain articles below  
those in the tariff of 1846, as pig iron from  
30 to 24 per cent.; bar iron from 30 to 24  
per cent.; steel in ingots from 20 to 15  
per cent.; was sustained by a majority of the  
New England States and the solid vote of  
the South, while the Middle States were  
nearly equally divided and the West was  
decidedly against the bill. In the tariff of  
1861 the duties on all articles were raised to  
a higher rate to meet the requirements of  
the Government in meeting the expenses of  
the rebellion of the Southern States. Scrap  
iron was rated at \$6 a ton; pig iron at \$6 a  
ton; iron bars at \$15, and steel at 1½ cents  
per pound. The act of 1866, in addition to  
being protective, was also framed to furnish  
revenue for the payment of the heavy drains  
upon the resources of the Government. The  
act of 1872, which established the rate at 90  
per cent. of existing duties, met with most  
opposition in the Middle States and least  
opposition in the West and South. The bill of  
1883, making further reductions, and which  
was regarded as a compromise bill, was gen-  
erally accepted, except at the South, where  
the demands were for greater reduction.

The Morrison bill, which has just been  
introduced, goes a step further than the act  
of 1883. It not only establishes the rate of  
duty on the various schedules, including  
metals, at 80 per cent. on existing duties,  
but prohibits the imposition on metals of any  
rate in excess of 50 per cent. ad valorem  
or its equivalent, and places iron and other  
ores on the free list. This system of reduc-  
tion was applied in the tariff act of 1872, in  
which the duties on iron and its manufac-  
tures were placed at 90 per cent. of the then  
existing duties.

## The Production of Pig Iron by States.

In another part of this issue will be found  
the details of the production of pig iron in  
the United States for 1883, by States and  
districts, as compared with the production  
for 1882, which have been made public by  
the American Iron and Steel Association.  
In connection with the statistics of produc-  
tion, the details of stocks are also given.  
These statistics present some curious facts.  
It will be found that, although the aggregate  
production of the country differed very little  
in 1883 from 1882, yet the difference was  
very great in many of the States, some of  
them largely increasing their output and  
others as heavily diminishing their produc-  
tion. Prominent among the States showing a  
gain in 1883 over 1882 is Pennsylvania, which  
is followed in the order of increased tonnage  
by Virginia, Alabama, West Virginia, Cal-  
ifornia, Georgia, Texas, Colorado, Massa-  
chusetts, Maine and Oregon, while Wash-  
ington Territory, which made no pig iron in  
1882, figures among the producers in 1883.  
The State showing the heaviest loss in tons  
in 1883, as compared with 1882, is Illinois,  
followed in order by New York, New Jersey,  
Michigan, Wisconsin, Ohio, Kentucky, Mis-  
souri, Maryland, Connecticut, Tennessee,  
Minnesota and Indiana, while Vermont,  
North Carolina and Utah Territory, which  
produced pig iron in 1882, made none in 1883.

Pennsylvania never attained so large an  
output in any year as in 1883. Her gain  
over 1882 was nearly 200,000 net tons,  
which was all in bituminous pig iron, as the  
production of both anthracite and charcoal  
pig iron decreased. The prominence of  
Pennsylvania among the pig-iron producing  
States is forcibly shown by the percentage  
of the whole output of the United States  
which she contributes. In 1882 this per-  
centage was 43, but in 1883 it reached 51, or  
a little over half the country's entire prod-  
uct. The gain in Pennsylvania in 1883  
was in the Lower Susquehanna district, the  
Shenango Valley and Allegheny County.  
(Pittsburgh, it may not be out of place to re-  
mark, is in Allegheny County.) Heretofore  
the most productive pig-iron district in the  
State, and therefore in the country, has been  
the Lehigh Valley, but in 1883 Allegheny  
County rose to the head, producing 592,475  
net tons, against 575,987 tons in the Lehigh  
Valley. The prominent position thus gained  
by Allegheny County will undoubtedly be  
maintained for a long time, as the conditions  
are all favorable. The gain in the Southern  
States has been marked, but is not so large  
as has been predicted. The following table  
shows the production of the three leading  
Southern pig-iron producing States in 1883,  
as compared with 1882:

	1882.	1883.
Alabama.....	173,465	119,765
Georgia.....	138,997	87,731
Tennessee.....	138,963	137,609
Total.....	451,425	345,105

It will be observed that Tennessee actually  
decreased in production, but in Alabama and  
Virginia the increase over 1882 was strik-  
ingly large. Both the last-named States  
doubled their production of coke pig iron.  
Kentucky and Georgia rank so far below  
these three States in production that we  
have not included them in this exhibit of  
Southern progress. Kentucky shows de-  
creased production, however, while in  
Georgia there was a slight increase.

The relative rank of the different sections  
of the country in the production of pig iron  
can be shown by dividing the States into the  
following groups: Northeastern, embracing  
all the States east of Ohio and north of Mary-  
land; Southern, all the States usually con-  
sidered as constituting the South, except  
Missouri; Western, all the States west of  
Pennsylvania and West Virginia, north of  
Kentucky and east of Colorado; Pacific, all

the Rocky Mountain and Pacific slope States.  
The production of these sections was as fol-  
lows in 1883, as compared with 1882:

	1882.	1883.
Northeastern.....	Net tons. 3,144,764	Net tons. 3,082,304
Southern.....	699,260	577,375
Western.....	1,353,634	1,487,131
Pacific.....	29,334	31,513
Total.....	5,126,992	5,178,123

## The American Merchant Marine.

Various bills affecting American shipping  
interests have been introduced at the pres-  
ent session of Congress, but very few of  
them have attracted much attention. They  
cover all kinds of projects, from the old and  
very familiar one permitting the privilege of  
purchasing ships anywhere, to the equally  
venerable one authorizing lucrative mail-  
carrying contracts with exclusively Ameri-  
can built and American owned vessels.  
Some of these bills have been heard from  
since their reference to committee, but  
others have evidently been consigned to  
oblivion. The measure receiving the most  
favorable consideration, and which appears  
reasonably certain of being made the basis of  
practical legislation, is that brought forward  
by Mr. Dingley, member of the House of  
Representatives from Maine. Mr. Dingley  
has paid very great attention to this subject,  
and, as he comes from a State vitally inter-  
ested in shipbuilding and shipowning, his  
views have been received with greater favor  
than if he were a mere theorist with a  
hobby. He was the author of a shipping  
bill which came very near passing both  
Houses of Congress last winter.

The bill which he has recently introduced  
removes or reduces the restrictions in the form  
of special taxes, dues, fees and antiquated  
regulations which have so long hampered the  
owners of American vessels when competing  
with the vessels of other nations that levy no  
such burdens on their marines. Mr. Dingley's  
bill has been considerably amended by the  
Senate Committee on Commerce, who have  
reported a bill which not only removes or  
reduces the vexatious burdens of which our  
shipowners justly complain, but provides for  
more liberal payment to American vessels  
for carrying the mails. The amount to be  
so expended by the Government is limited to  
the gross revenues of the Post-Office Depart-  
ment on mail matter sent to and received  
from foreign countries during the fiscal year  
next preceding the year in which the con-  
tracts are made, less the amount paid for  
transportation on foreign vessels. It is  
stated that, taking last year as a basis, this  
aggregate would be from \$1,600,000 to  
\$1,700,000. In order to guard the interests  
of the Government in the distribution of this  
fund, the Postmaster-General is authorized to  
contract with American vessels for a sum  
not exceeding \$1 per nautical mile for a round  
trip, and the contracts are to be made with  
the lowest bidders. A clause in the bill  
allows a drawback of 90 per cent. on the  
duties paid on imported materials used in the  
construction of vessels built in this country  
for foreign account, whether the vessels are  
built wholly or in part of foreign materials.  
Also, vessels engaged in the foreign trade, or  
between the Atlantic and Pacific ports, are  
to be permitted to withdraw free of duty  
from bonded warehouses all articles of  
foreign production for their supply.

The sentiment of the Senate Committee on  
Commerce is strikingly shown in the fact  
that the bill referred to received their unan-  
imous report, though a minority was author-  
ized to offer an amendment providing for  
the admission of foreign-built ships to Ameri-  
can registry and the importation of ship-  
building materials free of duty. The pros-  
pects seem favorable for the passage of the  
bill in the shape in which it came from the  
Senate Committee, as the House Committee on  
Shipping have agreed to adopt and report it.  
The united action of these two committees  
must exert a powerful influence in favor of  
this much-needed measure. Our people gen-  
erally are profoundly interested in the solu-  
tion of the ship problem, and the amended  
Dingley bill contains so many features to  
commend it to popular favor that its passage  
will certainly be regarded as an immense  
stride in the direction of the restoration of  
our merchant marine to its ancient promi-  
nence.

In our issue for January 31 we commented  
on some remarkable assertions in favor of  
free trade, attributed to Pittsburgh man-  
ufacturers by the New York Herald. We  
have received from the gentlemen alluded to  
no denials of the truth of the statements  
made by the Herald reporter, but we have  
been informed privately that the printed in-  
terview with the prominent steel manufac-  
turer whose name was withheld by the  
Herald was a "huge joke," the manufac-  
turer in question having purposely misled  
the reporter by affecting to be a rabid free  
trader, his true sentiments being in favor of  
protection. We are not impressed with this  
explanation. There are three points about  
the matter which present themselves for  
consideration. First, the statement may be  
true, but the manufacturer whose views are  
quoted may be dismayed at the storm he has  
created, and now desires to extricate him-  
self from a position which certainly exposes  
him to much unfriendly criticism in a city so  
overwhelmingly devoted to protection as  
Pittsburgh. A very strong reason for cred-  
iting the reporter's statement is the fact  
that we have ourselves heard such senti-  
ments from the lips of just such a man as he  
describes. Second, the explanation given  
seems to be very weak. A protectionist

would certainly be playing a very stupid joke  
in pretending to entertain free-trade senti-  
ments when he knew that his views, as ex-  
pressed to the reporter of a prominent metro-  
politan newspaper, would be circulated in  
every direction and used to the disadvantage  
of his own cause. Third, it is incredible that a  
dyed-in-the-wool protectionist would express  
such views, even in jest. The sentiments  
of manufacturers on questions of political  
economy are usually as strongly implanted as  
their religious or political principles. A devout  
Baptist would not be likely to masquerade as a  
Methodist to the editor of a Methodist news-  
paper and find fault with immersion, and we  
could not possibly conceive of a true Demo-  
crat pretending, for jocular purposes, to be  
a Republican and bewailing the errors of his  
party to the reporter of a Republican news-  
paper.

## Utilization of Gas Products in Blast Furnaces.

A great deal of attention is being paid in  
England to the utilization in the production  
of ammonia and other substances of the waste  
gases from blast furnaces using raw coal. It  
has been estimated that \$1,000,000 a year of  
clear profit has been thrown away in Scot-  
land alone—not through ignorance of the  
value of the products contained in these waste  
gases, nor from the absence of methods of  
utilizing them, but merely from want of a  
simple trial as to whether or not the ordi-  
nary methods of recovering ammonia were  
capable of application to these gases. At  
several large furnace plants efficient systems  
have already been adopted, and have been  
in use long enough to indicate their value.  
Some furnace proprietors have even ven-  
tured the opinion that in course of time the  
production of pig iron in blast furnaces will  
be a secondary matter; that the iron could  
be sold at the cost of production, and a large  
profit still be made from the furnace work-  
ing by reason of the value of these products  
that have heretofore been allowed to waste.

At the Gartsherrie works of the Bairs,  
near Glasgow, all of the gases from the  
furnaces are washed and condensed before  
being sent to the hot-blasts. The result is  
not only the saving of the ammonia and  
other products, but the gas, being thus  
cleaned, does not clog up the stoves. The  
expense of cleaning is reduced; the blast is  
delivered with less loss by friction, and the  
heat secured is greater. It may be that at  
the present time in this country, where  
there is not the demand for ammoniacal  
products that there is in England, this project  
would not be economically successful, but  
it is nevertheless well for our furnacemen  
to keep close watch of these operations. It  
is also an interesting additional evidence of  
the fact that has been made so prominent in  
past years, namely, that the profit in the  
future in iron-making will in many cases be  
derived from what is now wasted.

## Australian Development.

The people of South Australia have ap-  
pointed Robert Dixon, a member of the Aus-  
tralian Parliament, as commissioner to obtain  
exhibits for a world's fair to be held at  
Adelaide, in 1887, in commemoration of the  
founding of the Colony. Mr. Dixon is now  
in this country, and will spend about four  
months visiting New York and other Ameri-  
can cities. The cost of the exhibition is  
estimated at \$1,500,000, and \$900,000 has  
been appropriated for the construction of a  
permanent building, the Government assum-  
ing responsibility for the entire expenditure.  
The resources comprise a near-by population  
of about 300,000, and of about 3,000,000 in  
the group of Colonies. The exhibitions at Mel-  
bourne and Sydney proved highly beneficial  
to the Colonies, and the Adelaide exhibition  
is expected to be as attractive in every particu-  
lar.

The Sydney Morning Herald furnishes  
some detailed statistics respecting the in-  
crease in the foreign commerce of Australia,  
which, although not fresh, are apparently  
published for the first time. The figures  
generally indicate a condition of consid-  
erable commercial activity. The record of the  
gross value of imports and exports by Col-  
onies, with the gain between the years 1872  
and 1882, was:

	Imports 1882.	Increase since 1872.
New South Wales.....	\$31,381,180	\$12,072,634
New Zealand.....	8,609,270	2,144,583
Queensland.....	6,313,463	3,000,746
South Australia.....	6,707,728	4,906,917
Tasmania.....	1,670,522	600,690
Victoria.....	18,748,061	4,870,895
Western Australia.....	508,755	282,090
Total.....	\$63,844,259	\$29,945,558



made more than 48 boxes a week he was compelled to pay the amount received for the overproduction into the association. Under the new rule the average of all the workers at a given furnace must be 48 boxes before anything is to be paid into the association. In other words, if, under the old rule, in a 10-pot furnace, nine pots or workmen made only 40 boxes a week and one made 55, though the average would be less than 48 to the whole furnace, the man making the 55 boxes had to pay what he received for the extra seven boxes into the association. Under the new rule the furnace can make 480 boxes before anything is paid in, though two thousand or three men may have made 50 or 55 boxes.

#### Russian Oil Fields.

According to apparently well authenticated reports, the American export trade in petroleum is seriously menaced by competition from Russia. Now that petroleum has become an article of great importance among our exports, the statements lately coming to hand seem worthy of attention. For the year 1883 our total exports of petroleum, as officially reported, reached the handsome figure of nearly \$48,000,000, which was a gain of about \$3,000,000 over the previous twelve months, and just now petroleum is more than ever an important item in maintaining a favorable balance of trade. Russian reports show that rapid advances have been made in the development of the Baku oil region, the total production having risen from 30,000,000 gallons in 1875 to 200,000,000 gallons in 1882. Americans who have gone out there have done much to introduce improved methods. The information received from that quarter is generally too indefinite to be satisfactory, especially as to the quality of the merchantable article. Mr. Charles Marven, a newspaper writer of some repute, who claims to have made a thorough exploration of the oil district, says, in a London pamphlet, just issued: "A peculiarity of the Baku petroleum is its high specific gravity as compared with American having the same boiling point. It gives 10 per cent more light than American, and is more readily drawn up the wick to the flame. The high specific gravity is availed of by manufacturers of lubricating oil, who send into European markets an oil of .940 specific gravity, without any extraneous addition." According to this authority the oil wells are enormously productive. One that he saw last September was "spouting nearly 300 feet high, and ejecting 2,000,000 gallons of oil per diem!" Already, if we may believe Mr. Marven, this oil has to a great extent superseded American oil in the Russian market, and is making its way via the Volga and by rail into Southern Europe. Can the American exporters maintain themselves indefinitely against such competition?

We conclude this week Mr. Cowper's paper on the "Inventions of Watt," the first portion of which appeared in our issue of January 31 of the current year. The exceptional facilities which the author had in inspecting the early models, and the fact that the engravings are careful reproductions of the drawings made from them, contribute in no small measure to the value of the paper. Aside from its historical interest, it is of the utmost importance, showing in several instances the original crude forms of instruments which in the course of time have developed into appliances now so well known and practically indispensable in steam engineering. It was found necessary to make suitable selection from the mass of available particulars, and as some of the models were simply duplicates of others, slightly varied in form, only the most important of them are considered. Watt's patents were regarded as probably the most reliable for the dates of his inventions, and these were consequently obtained from such sources. Many of the models agree with the patent drawings, but some were found which were not shown in the patents and some drawings of which there were no corresponding models. On the whole, Mr. Cowper's attempt to furnish an interesting historical sketch of the subject has been eminently successful, and careful perusal of the paper will, we think, sustain this opinion.

Strenuous efforts to secure a reference to arbitration of the dispute over the attempt to enforce a reduction of 10 per cent. in wages have been made by the unionists employed at the Eston Steel Works of Bolckow, Vaughan & Co., near Middlesbrough, England, where a lockout is now in progress. Mr. Windsor Richards, the manager, decidedly refuses to accept arbitration. Mr. Richards's ground for this is not opposition to the principle of arbitration, but he has deliberately come to the conclusion that it is impossible for his works to continue running without this reduction of 10 per cent., and he believes that were the question to be submitted to arbitration, and anything less than 10 per cent. reduction awarded, he still would not be able to give the men work, so he honorably prefers to be put in the position of opposing arbitration rather than to enter into it, and if it should go against him, indirectly, by stopping his works, refuse to abide by the result of the submission. This is certainly honorable. A striking example of how large bodies of men will allow themselves to be intimidated by a very small, compact organization is given in this strike. At the Eston Steel Works some 3000 men are employed. Of these all but 137 are non-unionists. All of the non-

unionists have agreed to accept the reduction of wages, but at a meeting of the unionists recently, at which a ballot was taken, a majority of these 137 resolved to stand out, and, as a result, the works are idle.

The people of New Orleans are expecting to have a grand World's Exhibition in that city next December, and have commenced the erection of buildings. The main structure will be 1400 by 900 feet, ground dimensions, comparing well in respect to size with the exhibition building in London. Machinery Hall will extend the entire length. Mexico will have a conspicuous position, although, perhaps, not overshadowing. General Diaz, who heads the Mexican Commission, is giving to the preparations his personal supervision, and a battalion of Mexican troops will give dignity to the approaching occasion by their presence. The merchants of New Orleans claim to take a special interest in Mexico as their nearest neighbor, and do not mean to be circumvented in any way by St. Louis and Chicago, who also are expecting to profit from the improved railway connections with the Mexican capital and intermediate States.

The Ways and Means Committee of the House of Representatives have very properly decided to permit interested persons to appear before them in relation to the Morrison tariff bill. The disposition of several of the committee to grant no hearings was very marked, but the majority were not disposed to act upon a measure of such importance without giving the people whose business is directly affected by the proposed legislation an opportunity to express their views. The day fixed for the consideration of the metal schedule is Saturday, the 16th inst., at which time, we presume, the metal interests of the United States will be represented before the committee by a large delegation.

An approaching event of considerable importance is the completion of the Mexican Central Railroad Company's main line to the United States. This event is announced officially to take place about the middle of March. The road will be open for through traffic between April 1 and 15. The connection by rail of the City of Mexico with the railroad system of the United States is an achievement which will undoubtedly mark the beginning of an era in Mexican progress and prosperity.

#### WASHINGTON NEWS.

##### THE MISSISSIPPI RIVER COMMISSION.

February 6.—A bill was introduced in the Senate by Senator Gibson, to amend the act of June 28, 1879, which created the Mississippi River Commission. It provides for the extension of the work of the commission to all the navigable tributaries of the Mississippi River; for the increase of the membership of the commission from seven to nine, the additional members to be selected from the Engineer Corps of the Army, and for the increase of the compensation of the civilian members from \$3000 per annum to \$4500 per annum. It also provides that the commission shall report to the Chief of Engineers and the Secretary of War, instead of, as now, directly to the Secretary of War, and that they shall report upon the "channel-dyke and training wall" system, as well as upon the jetty outlet and levee systems.

##### THE NEW SHIPPING BILL OF THE SENATE COMMITTEE ON COMMERCE.

February 7.—The Senate Committee on Commerce to-day authorized Senator Frye to report for passage a new bill for the relief of American shipping. This measure has been prepared by the committee as a substitute for all the bills referred to it on the same general subject. Its main features are as follows: It grants authority, under certain circumstances, for American vessels to employ any officer, other than a captain, of foreign birth. The prohibition of the payment of advance wages, under heavy penalties, is extended to foreign as well as American vessels. A modification is made of the law respecting three months' extra wages, repealing it in certain cases and in others limiting it to one month. Sections 4585, 4586 and 4587, Revised Statutes, relating to the assessment and collection of a hospital tax for seamen, are to be repealed, and in their place it is provided that hereafter the marine hospitals shall be maintained at the expense of the United States. The bill further provides that all articles of foreign production may be withdrawn from bonded warehouses for the supply of vessels engaged in the foreign trade, including trade between the Atlantic and Pacific ports of the United States, free of duty. A drawback of 90 per cent. is allowed on imported materials used in the construction of vessels built in this country for foreign account, whether such vessels are built wholly or only in part of foreign materials. [Under existing law the drawback is applicable only to vessels built entirely of foreign materials.] The individual liability of a shipowner is to be limited to the proportion of any debts or liabilities that his individual share of the vessel bears to the whole, and the aggregate liabilities of all the owners of a vessel shall not exceed the value of such vessel and pending freight. The law which authorizes the Post-Office Department to detain any American vessel bound for a foreign port, and place on board the United States mails, compelling her to deliver them at the post office of the foreign port for 2 cents a letter, is to be repealed. In lieu of it the bill provides that the Postmaster-General shall be authorized to contract with American vessels for carrying United States mails to and from foreign ports for a sum not exceeding \$1 per nautical mile for the round trip, the contracts to be made, after advertisement, with the lowest bidders. The aggregate of such contracts, however, shall not exceed the gross revenues of the Post-Office Department of the United States on mail matter sent to and received from foreign countries during the fiscal year next preceding the year in which the contracts are made, less the amount paid for transportation on foreign vessels and the net amount paid foreign postal administrations for intermediary territorial and sea transit of such vessels. [It is understood that, taking last year as a basis, this aggregate would be from \$1,600,000 to \$1,700,000.] The bill practically adopts what is called the "Dingley section" as to the tonnage tax, reducing it upon vessels trading with certain foreign ports to 3 cents a ton for each entry, the aggregate for a year not to exceed 15 cents a ton, and with certain other foreign ports to 6 cents per ton an entry, the aggregate not to exceed 30 cents a ton. This bill received the unanimous support of the Committee on Commerce, but a minority was authorized to offer an amendment to the bill in the Senate providing for the admission of foreign-built ships to American registry and the importation of shipbuilding materials free of duty. With regard to the section which declares that "to encourage shipbuilding a drawback of 90 per cent. is allowed on imported materials used in the construction of vessels built in this country for foreign account, whether such vessels are built wholly or only in part of foreign materials," John Alexandre, of F. Alexandre & Sons, owners of the New York, Havana and Mexican Line, sent a communication to Senator Frye, of which the following is the substance: "This section will afford a great deal of relief to all connected with American shipping interests, as well to the builder as those running vessels, and particularly to lines running to foreign countries. From our experience, since 1867, running to Cuba and Mexico under American and British flags, we would go still further than the proposed bill, as follows: 'To encourage American shipbuilding a drawback shall be allowed the owner of all materials of American production or manufacture used in the construction or repairs of an American vessel equal to the amount of duty on the same quantity and quality of foreign materials.' If this could not be secured, then the 90 per cent. clause should apply to American vessels engaged in the foreign trade. American shipping is burdened with every conceivable tax, National and State. If our line had not received, since 1867, a subsidy or mail contract from Mexico, we never should have been able to run a line of steamers between the two countries. The French Government has renewed its contract with the French Transatlantic Line to run steamers to Cuba and Mexico monthly, and to pay a subsidy of \$2,000,000 annually."

##### THE NAVAL APPROPRIATION BILL.

February 8.—The Naval Appropriation bill reported to the House to-day makes an appropriation of \$14,263,196, being \$8,392,304 below the estimate of the Secretary of the Navy, and \$1,631,238 below the appropriation of last year. The appropriation for the Naval Academy is the same as that of last year. For the construction of cruisers \$1,649,600 is appropriated, and for the care of ironclads \$5000.

##### LABOR STATISTICS.

The House Committee on Labor has ordered a favorable report on Representative Hopkins's bill for the establishment of a department of labor statistics. The measure provides for the appointment of a commissioner, who shall acquire all useful information on the subject of labor, its relations to capital, and the means of promoting the material, social, religious and intellectual prosperity of the laboring men and women.

##### A VALUABLE PUBLIC DOCUMENT.

On January 7, 1884, Mr. Morrill, chairman of the Committee on Finance, reported from that committee a resolution authorizing the printing of the existing tariff on imports into the United States, and the free list, together with comparative tables of present and past tariffs, and other statistics relating thereto. This publication, which will be ready in two or three weeks, will be of invaluable service in the tariff issue which is now inevitable in the political campaigns of the present year. It will be useful to the manufacturers as a means of comparison of the rates of duties at different times, and to the people at large, showing the effects of the various acts on imports and exports. The different heads of information are the old tariff, the new tariff, the Hawaiian reciprocity treaty, comparative tables of the tariffs from 1789 to 1883, inclusive; votes of the House of Representatives on the general tariff acts from 1789 to 1883, inclusive; the imports and exports and receipts from customs from 1789 to 1834, inclusive; the same from 1835 to 1883, inclusive; merchandise, value of exports and imports, 1835 to 1883; gold and silver coin and bullion, imports and exports 1835 to 1883, inclusive; merchandise, value of, imported, entered for consumption, 1867 to 1881, inclusive; and commodities, principal, amount of duties collected on, 1869 to 1883, inclusive.

##### ARGUMENTS ON THE TARIFF.

The chairman of the Committee on Ways and Means says, in explanation of the action of the committee on last Thursday, designating Wednesday, February 13, for a hearing of representatives of the cotton interests under the tariff; Thursday, February 14, for wool; Saturday, February 16, for metals, and Monday, February 18, for earthenware and glassware, that these arguments are to be confined to the general subject of the interests of the articles under the whole schedule, and not to any one class of articles. Any statements by experts must be submitted in writing and sent to the committee, when they will be printed for the use of the committee. It is intended to report the bill to the House by the 1st of March.

##### THE RECOGNITION OF TRADE DOLLARS.

February 11.—The House Committee on Coinage, Weights and Measures to-day agreed to report a bill for the exchange of the trade dollar for standard dollars or for their receipt for Government funds within two years. It provides for their recognition into standard dollars, and that the bullion shall be counted against the monthly purchases of bullion at bullion rates. The action of the committee was not unanimous, and the bill as it now stands will be opposed by Mr. Bland, chairman of the committee. He purposes offering

an amendment to strike out that portion of the bill which provides that the coins shall be counted as bullion against monthly purchases.

##### STEAMSHIPS AND THE MAILS.

February 11.—The Senate shipping bill, as reported last week by Senator Frye from the Committee on Commerce, was taken up by the House Shipping Committee to-day, and Representative Hunt was authorized to report to the House a bill covering such features of the Senate bill as are not embodied in the Dingley bill.

##### THE REPEAL OF INTERNAL REVENUE LAWS.

February 11.—The following communication was addressed to Chairman Morrison, of the Committee on Ways and Means, to-day: "The undersigned, who are in favor of the repeal or modification of the internal revenue laws, respectfully request a hearing before your committee at as early a day as may be convenient." This was signed by Congressmen Dibrell, Caldwell and Taylor of Tennessee, Cabell of Virginia, Green and Scales, of North Carolina, and Clemens, of Georgia. Mr. Dibrell, who is one of the leaders in the movement, states that he could easily have obtained 40 or 50 signatures to the letter had he deemed it necessary or expedient. There is a probability that the subject of the modification of the revenue laws will be brought before the House on a bill introduced by Mr. Green last week. Misled by its title, "To encourage the cultivation of fruits," the Speaker allowed it to be referred to the Committee on Agriculture. It simply repeals the internal revenue tax on brandy made from grapes and all kinds of fruit. Mr. Green said to-night that seven of the members of the committee had agreed to report it favorably. When reported it will be subject to a reference to the Ways and Means Committee, and its friends propose to get a test vote on the motion to refer if they can.

##### SENATOR BECK ON THE MORRISON BILL.

Senator Beck, in conversation on the subject of the Morrison bill, said: "I believe if the Committee on Ways and Means report the right kind of a bill on tariff reform, it will not only pass the House, but the Senate. The Morrison bill fairly expresses the Democratic idea of tariff reform, and as a basis of legislation on the subject is about as fair a statement of the theory of reform as we could have. I believe in the Democratic party taking a position on this subject, not simply in party platforms, but by the passage of a bill essentially Democratic in its principles. The Morrison bill may be modified, but I presume not materially. Its course in the House will be closely watched, particularly as regards the conduct of party leaders for and against the measure. In fact, it may change the relations of men to parties, not only Democrats, but Republicans. I believe that the disposition to reduce revenue is very general. In the tariff act of 1872 there was a reduction of rates, but, under the cry of providing for the sinking fund, the rates were restored. This time that plea will not work. The action of the Finance Committee of the Senate, of which I am a member, and of the Senate, will depend much upon the kind of bill the House sends up. I have no right to say what other Senators may do, but I can imagine such Senators as Ingalls, Plumb, Van Wyck, and perhaps Sabin, voting for lower rates. We might lose McPherson, but I think that is all. In my opinion, with a fair bill we can carry the Senate. This will then make a fair issue before the people. If they wish further reduction, they will have the issue in the campaign, and the people can then decide for themselves whether they wish further reduction."

##### GOVERNMENT EMPLOYEES AND THE EIGHT-HOUR LAW.

The bill recently introduced by Representative Hopkins has excited much inquiry on the part of the members of districts in which public works are in operation. It is said that the bill, if passed, will open an endless subject of adjudication. The following is the text of the bill:

A bill to pay to employees of the Government wages hitherto withheld in violation of the eight-hour law.

Be it enacted, &c., That whoever, as a laborer, workman or mechanic, has been employed by or on behalf of the Government of the United States since the 18th day of May, 1872, the date of the approval of the act of Congress constraining a former act constituting eight hours a day's work by the day, shall be paid for each eight hours he has been employed as for a full day's work, at the price per day called for by the contract under which he was so employed.

Sec. 2. That all claims for labor so performed in excess of eight hours per day are hereby referred to the Court of Claims, to be adjudicated upon the basis that eight hours constitute a day's work, and are to be paid for as such, at the price per day called for by the contract, express or implied, under which the labor was performed, and judgment given against the United States in favor of each claimant for the amount found due, to be paid as other judgments of the Court of Claims against the United States.

#### TRADE PUBLICATIONS.

##### Iron Beams.

We have just received from Messrs. Chas. G. Eckstein & Co., of New York, a book of sections of the Luxembourg Mining and Saarbrücken Iron Works Company, Limited, of Burbach, Germany, manufacturers of beams, channels and angles of all sizes, for which company they are the sole agents for the United States. The book, which contains illustrations of full-sized sections, is about 12 x 16 inches, and contains 32 double-page plates, each illustrating a number of sections. The general conditions of sale and remarks upon the table of safe loads, which are contained in the first few pages, are, for convenience, written in German, French, English and Italian. Following are a number of tables giving dimensions, area of section, weights, moment of inertia, moment of resistance and safe loads of I-beams, the loads being in kilograms and the dimensions in meters and millimeters, the table being calculated for distances between supports of from 1 to 12

meters, varying 1/2 meter at a time. Besides these tables in the book there is a supplemental card, the dimensions and resistances being, however, given in British units, which is very convenient as saving a vast amount of troublesome recalculation. Passing on to the plates, we find the book filled with shapes illustrating great varieties of section, including a large number of I-beams of different dimensions, besides the ordinary channel bars, T-irons, &c.; also a great number of beams of peculiar section, applicable in special kinds of construction. Among these latter we may draw attention to Plate XV, which is devoted to a number of differently formed and dimensioned iron railway sleepers. The sections, we presume, illustrate the ordinary forms as used abroad, the rail being fastened down by an iron chain which is bolted to the sleeper. The necessity for the introduction of iron sleepers upon railways, or at least some substitute for the wooden ones ordinarily used, being so generally felt, this page of plates will deserve more than a passing interest. On looking over the different shapes illustrated in this book, there are two features which will particularly attract the attention of rolling-mill men and constructors. The first point is that in the majority of the Saarbrücken I-beams the fillets between web and flange are reduced to a minimum, thus giving far straighter flanges than are ordinarily rolled in this country. This has the advantage of giving to the beam equal strength and at the same time a somewhat diminished section. Whether the increased difficulty of rolling does not more than counterbalance the slight saving in material is somewhat questionable. The second point which will attract attention is the excessive thickness of web and diminished width of flanges as compared with the American beams. Unquestionably, the relative thickness of metal in flanges and web are such in these beams as to avoid those internal strains consequent upon the differences in the periods of cooling which will always result where there is a great difference between the thickness of the flanges and the thickness of the web. Naturally this makes a heavier beam without increasing its strength, and an examination of the table of strains of the different sections, as compared with the American beams, shows that the German standard sections exceed the American slightly in weight per yard for equal coefficients of safe load. The fact, however, that the German beams are rolled to depths of 16, 17, 19 and 21 inches, while the deepest American beam rolled at the present time is 15 inches, will strongly commend them to the use of architects and builders, as well as for the floor beams of bridges, as a most acceptable substitute for the compound riveted girder of equal strength.

##### Iron Railings, Fencing, &c.

We have received from the Composite Iron Works Company, Reade and Church streets, an advance copy of their catalogue of patent composite iron railings, gates, &c. The catalogue is one of the finest devoted to this line of goods that it has ever been our pleasure to examine. In size it is approximately 10 x 14 inches, contains some 75 pages, and is printed upon a fine quality of book paper, the illustrations being of unusual excellence and clearness. By referring to some features of its contents, we think we shall be able to give our readers a general idea of its excellence. On the inside title-page a view of a gateway on Boston Common is presented. This work was erected by the Composite Iron Works some time since, and serves in this connection as a very pleasing introduction to the line of goods shown. The second page is devoted to a description of composite chilled ironwork, and is illustrated by a diagram showing the construction employed in railings, gates and other work. Following this is a general view of the establishment of the company at Long Island City, L. I. A second illustration shows an interior view of the foundry, and represents workmen engaged in various kinds of work, from blacksmithing to "pouring off." The scene is animated, and is well calculated to impress the reader with the magnitude of the establishment described. The succeeding page shows still other views in the works of the company, wherein various lines of work are being performed. On the fifth page the catalogue proper commences, and it and succeeding pages contain a large assortment of gates, fencing and railing, embodying the construction peculiar to this company. Among the specialties may be mentioned composite lawn fence, hurdle lawn fence, iron lawn guards and wire-cloth netting fence. Following the latter are a number of designs of pipe railing suitable for cemetery work and similar places. A large assortment of designs of iron posts are next presented, following which are representations of a folding safety gate which this company manufactures. Two pages are devoted to views of wrought-iron gates erected for James Gordon Bennett at Newport, R. I., and William Astor, at the same place. We mentioned these two designs some time since from the point of view of the plates. Several designs of heavy wrought-iron and composite iron gates are next presented, showing work adapted for use in almost every possible situation. Cast-iron railings for stoops of city houses, and wire area gates and cast-iron railings for city yards, in rustic and other designs, complete this part of the book. Some designs of circular stairs, wrought-iron shutters and wrought-iron doors are next given; then several designs of iron verandas and iron summer-houses, which in turn are followed by lawn goods, embracing fountains, settees and iron tree guards. Four designs of opera chairs are shown, some iron bedsteads are given, and the book closes with illustrations of window guards, and opera-house gates so constructed as to fold out of the way when not in use. The letter-press and illustrations are handsomely executed, and the book is one that will give pleasure to all who have occasion to examine it.

The Havana Gazette has published a royal decree that invoices of all merchandise imported into Cuba must be certified by the Spanish Consul at the port from which the merchandise is shipped. This is indispensable for custom-house entry and approval of captains' manifests.















NEW YORK, Feb. 5, 1884.

GENTLEMEN: In common with several  
houses in the trade, we are in receipt of a  
circular letter issued by Messrs. Graham,  
Emlen & Passmore, and dated February 1,  
1884, in which the following language is  
used, viz.: "We learn that certain parties, in  
defiance of our rights, are offering Bear-Cat  
Lawn Mowers that not only are a very broad  
infringement on the Passmore patent, but are  
almost a trade imitation of the Philadel-  
phia." As some correspondence has passed  
between these gentlemen and ourselves, the  
inference is that the circular refers to our new

**Plate Iron.**—Buyers seem more willing to take hold, and consequently there is a

**Lead.**—There sold during the week between 400 and 500 tons Common Domestic at \$4.40 to \$4.10, and since then \$4.15 to \$4.25 is asked. Common and Refined command the same price. St. Louis reports great strength at 3 1/2%. Spain exported during the first 11 months of the year 116,341 tons of Lead, against 106,972 in 1882, and 94,991 in 1881. From London we hear to-day that there is no change in the market. Since yesterday manufacturers have partially lowered their prices, which are now: Lead Pipe, 6 1/2%; Sheet Lead, 7 1/2%, leaving Tin-lined Lead

Volvoilers, cse.	1	304		
Pumps, pkgs.	7	3,425		
Nails, keggs.....	45	190		
<b>Christiane.</b>				
Ad. imp., pkgs.	5	260		
Ad. fly., pkgs.	5	370		
<b>London.</b>				
Ad. fly., pkgs.....	177	8,407		
Ad. flies, pkgs.....	467	1,300		
Beetles, cse.	7	1,025		
Ad. imp., pkgs.	153	1,483		
Brackets, cse.	1	250		
Rubing, cse.	1	350		
Wringers, cse.	1	350		
Ad. fly., pkgs.	24	5,058		
Saws, cse.	2	38		
Pumps, pkgs.	5	210		
<b>Autorp.</b>				
Sew. ma., cse.	102	2,125		
Ad. fly., pkgs.....	23	414		
<b>Aristol.</b>				
Nails, cs. ....	3	106		
<b>British Australia.</b>				
Ptm., gals.	96,000	13,252		
Hdw., pkgs.	.....	954	13,252	
Ad. imp., pkgs.	34	871		
Pumps, pkgs.	1	170		
Nails, cs.	127	455		
Mf. iron, pkgs.	119	2,797		
Ad. fly., pkgs.	33	1,740		
Clocks, pkgs.	160	3,000		
Sew. ma., cse.	133	480		
Wringers, cse.	113	480		
Writers, cse.	6	112		
Eyeglasses, cs.	5	317		
Rifles, cs. ....	10	1,442		
Cartridges, cs.	15	308		
Ad. fly., pkgs.	5	190		
Sew. mach oil				
cases	50	400		

Lead pipe, cu.	5	108	Mr. iron, pkgs.	4	59
Tin, bxs.....	10	80	Ptm., gals..60,000		6,885

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**COAL.**

The prices current (prices paid by local dealers) for Bags, &c., are as follows:			
Canvas, Linen	lb.	34	¢ 4
White Cotton, New	..	34	¢ 4
No. 2	..	34	¢ 2 1/2
White, No. 1	..	34	¢ 4
No. 2	..	34	¢ 2
Seconds	..	34	¢ 2
Soft White	..	34	¢ 1 1/2
Mixed Bags	..	14	¢ 6
Junny Bagging	..	14	¢ 6
Blue Butts	..	14	¢ 6
Blue Bagging	..	14	¢ 3 1/2
Book Stock	..	14	¢ 2
Coopers	..	34	¢ 4
Waste Paper and Scraps	..	14	¢ 6
Kentucky Bale Rope	..	34	¢ 4









STAR HACK SAW

MEDINA, OHIO, Feb. 1, 1884.  
Millers Falls Co., 74 Chambers St., New York:  
GENTLEMEN—Please send me 12 more of your new Hack Saws like the sample sent a few days ago. It cuts truly wonderfully. Our machinist sawed off a round bar of steel, 1 1/4 inches in diameter, in about three minutes. Just as soon as he cut it off he handed over the money for the saw, declaring it was his property.

Respectfully,  
A. I. ROOT,  
Publisher of "Gleanings in Bee Culture."

KANSAS CITY, Mo., Jan. 30, 1884.  
Millers Falls Co., New York City, N. Y.:  
Inclosed please find \$3 for two of your Star Hack Saws and two dozen saw blades for same. The two sets were received to-day which were ordered last week, and their performance is so satisfactory that two of my friends asked me to send for sets for them.

Very respectfully,  
R. H. BACOT.

We have sold many thousands of these Star Hack Saws, and, so far as we have heard, every one of them has given satisfaction. Hardware Dealers in all places will promote their own and the interests of their customers by keeping these goods in stock. There is a fair profit on them and not a bit of risk, as we will take back at any time all the saws which you wish to return, and pay freight both ways. Send for Price List.

## MILLERS FALLS CO.,

74 Chambers Street, - NEW YORK.

**CHAMPLAIN**  
Forged Horse Nails.  
MANUFACTURED BY THE  
**NATIONAL HORSE NAIL CO.,**  
Vergennes, Vermont.  
HOT FORGED AND COLD HAMMERED POINTED. MADE OF BEST  
NORWAY IRON AND WARRANTED.  
WAREHOUSE  
97 CHAMBERS AND 81 READE STREETS NEW YORK.  
DURRIE & McCARTY, Sole Agents.

## BONNEY VISE AND TOOL CO., Limited,

MANUFACTURERS OF



### Bonney's Pat. Vises,

Machinists' Tools and Hardware Specialties.

OFFICE AND WORKS

3015 CHESTNUT ST., PHILADELPHIA, PA.

As an evidence of the popularity of Bonney's Patent Vises, we have sold over 300,000 of them within the past four years, and the demand is still increasing.

MANUFACTURERS OF

GENUINE BRONZE, BRASS, AMERICAN BRONZED AND JAPANNED  
**HARDWARE,**

Rim and Mortise Locks, Knobs and Escutcheons,  
Apple Parers, Registers, Bronze and Cast Butts,

STATIONERS' HARDWARE, &c.,

READING HARDWARE CO., Reading, Pa.

VARIETY IRON WORKS.

ALFRED C. REX & CO.,

MANUFACTURERS OF

Hardware Specialties, Iron Toys, Novelties,

—AND—  
HOUSE-FURNISHING HARDWARE.

Main Office and Factory, FRANKFORD, PHILADELPHIA.

Philadelphia Sample Office, 415 COMMERCE STREET. New York Branch Office, 128 CHAMBERS STREET.

BRAMHALL & SPIER, Managers.

Spring Specialties—Lemon Squeezers, Steel Ice Tools, Steel Blade Hatchets and Axes, Egg Beaters and Cake Mixers. Send for Catalogue.

S. CHENEY & SON,  
MANLIUS, N. Y.

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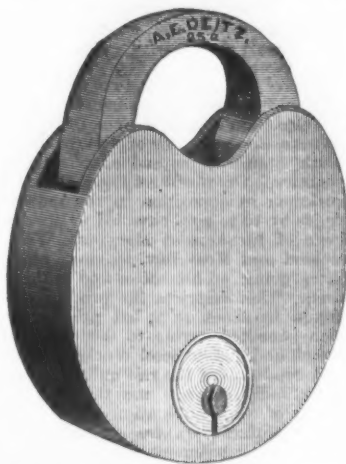
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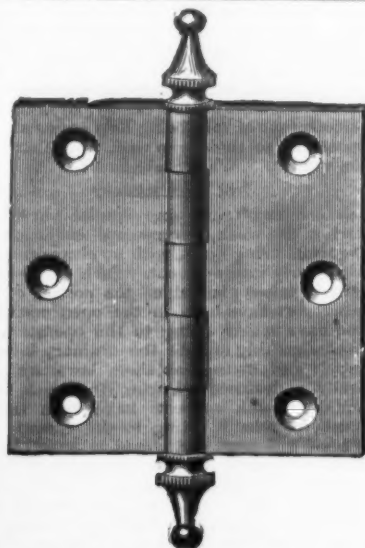
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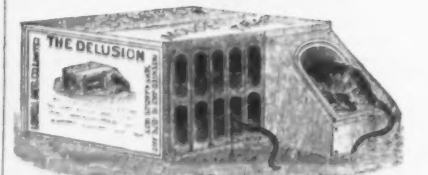
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THE DELUSION MOUSE TRAP.



The Mouse goes in to get the bait,  
And shuts the door by his own weight,  
And then he jumps right through a hole,  
And thinks he's out; but, bless his soul,  
He's in a cage, somehow or other,  
And sets the trap to catch another.

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**PITTSBURGH AND VICINITY.**  
Henry Stanton, assignee of the Manchester Iron and Steel Company, has filed a par-  
account showing that he has extinguished  
o,ooo of the company's debts, leaving the al  
assets \$312,022.57 and the liabilities







yet to be met \$150,587.50. A cash dividend of 35 per cent. will be paid as soon as the account is confirmed.

#### WEST VIRGINIA.

The Standard Nail and Iron Company, of Clifton, are increasing their plant of nail machines to 125.

#### GEORGIA.

The Georgia Car Company are removing their works from Cartersville to Anniston, Ala., where they will recommence the manufacture of railroad cars.

#### OHIO.

Among some of the recent shipments of the Cummer Engine Company, of Cleveland, is a 20 x 42, 287 horse-power engine, to the A. T. Stearns Lumber Company, Napa, Cal.; a 12 x 24, 80 horse-power, to M. Benner, Chicago, Ill.; a 10 x 20, 55 horse-power, to the Elithorpe Air-Brake Company, Chicago, Ill.; a 10 x 20, 55 horse-power, to E. M. McGillin & Co., Cleveland, Ohio; a 12 x 30, 95 horse-power, to the A. Plamondon Manufacturing Company, Chicago, Ill.; a 13 x 24, 105 horse-power, to the Joshua Hendy Machine Works, San Francisco, Cal.; and an 18 x 36, 215 horse-power, to the Cypress Lumber Company, Apalachicola, Fla. The Variety Iron Works have just sent in their order for a 16 x 30, 170 horse-power engine, and the Dominion Wadding Company, Sorel, P. Q., have ordered a 14 x 30, 130 horse-power Cummer engine. Mr. W. B. Pierson, manufacturer of the Cummer Engine Company's Chicago Branch, has just received an order for a 24 x 48, 414 horse-power Cummer engine, from the Paine Lumber Company, Oshkosh, Wis., notwithstanding the fact that all the prominent automatic engines in the market were being pressed upon the Paine people.

The Jefferson Iron Works, at Steubenville, lose over \$2000 through damages caused by the flood.

The employees at the Girard Iron Company's furnace, at Girard, resumed work last week, having accepted a reduction of 10 per cent.

#### MISSOURI.

The Moran Bros. Bolt and Nut Manufacturing Company are about to add a new nut-lock to their list of manufactures.

The Shickle, Harrison & Howard Iron Company are working three pits, and melting about 90 tons of iron a day. When the improvements they now have under way are completed, they will have a capacity to consume daily 250 tons of iron.

The greater part of the buildings of the N. O. Nelson Manufacturing Company, of St. Louis, were destroyed by fire on the morning of February 3. The loss on machinery and stock is estimated at \$100,000, almost all of which is covered by insurance.

The attempt to enforce a reduction in the wages of the stove molders of St. Louis has failed, and all the works which have started up are paying last year's prices.

#### MICHIGAN.

The Iron River Furnace Company are preparing to erect a charcoal blast furnace near Stambaugh. We are not informed as to the size of the furnace.

The United States Steel Plate Company has been organized at Republic for the purpose of making steel from pig iron by a new process, which is described as "an application of chemicals to iron plates, which changes them at once to the very hardest steel." The capital is stated to be \$1,000,000.

#### ILLINOIS.

The Columbia Iron Company, of Chicago, have added a new department to their business, wherein will be kept a full stock of flanged heads made by a new process. They are flanged on newly patented machines, whereby, it is stated, a perfect flange with an exact radius is made without boring any hole in the center of the head, and the knuckle is given at the same time extra strength.

The Western Nail Works, Belleville, General Powell, manager, started up February 11 with 131 machines, instead of 72, the number formerly used. Nearly all the product is nails, and 1000 kegs per day will be turned out. During the suspension, with the exception of one week devoted to repairs, they were busy rolling plate.

The Chicago Screw-Driver Works have been organized for the manufacture of Crawford's patent adjustable screw holder and driver combined. The works have been fitted up with the necessary machinery for the prosecution of the company's business and are in complete running order.

The June Manufacturing Company, of Chicago, have within the last few months added \$10,000 worth of new machinery and are turning out a large amount of special work, most of which requires very accurate work.

#### FOREIGN.

##### FRANCE.

(Moniteur des Interests Matériels.)

PARIS, Jan. 28, 1884.—Metals.—Business in this city has been dull; Copper and Tin have declined. Lead has been steady and Spelter has advanced. We quote at the close: Copper, 145 @ 150; Ingots and Slabs, 155; Best Selected, 160, and Pure Corrocor Ore, 155. Tin, Banca, 230; Billiton, 225; Straits, 221.25; Australian, 221.25, and English, 223.25. Lead, 29.75 @ 30.50, and Spelter, 32.75 @ 40.25. Iron.—The market here has declined to 14.50 @ 15.50 francs with Merchant and Flooring; we quote Charcoal, 24; Sheets, 23 @ 26, and Wire Nails, No. 18, in bulk, 27. At the North the market is quiet; the rolling mills decline making any sales ahead at ruling low figures. Shipments of Pig Iron from the Meurthe and Moselle district have been gradually lessening. Puddling Pig sells well enough, but Foundry do. does not. They quote the former 5.80, and the latter, 7.00. In the South, at St. Etienne, the first month of the year has brought no improvement. In the Haute-Marne Coke Merchant sells at 17.50 @ 18; Mixed, 18.50 @ 19; in the North at 16 @ 16.50. In the department of the Eure there exists quite a favorable state of affairs, especially the foundries are doing well; in the Oise the foundries are inactive, while Structural Iron producers are busy.

##### BELGIUM.

(Moniteur Industriel.)

BRUSSELS, Jan. 26, 1884.—Iron.—Although we have remained quiet during the week, the outlook is better, and prospects for better times come to us from France. It seems that the railroad companies there that made an arrangement with the

Government last year are legally bound to make a commencement of work without delay, so that the carrying out of M. Freycinet's great project stands better now than it ever did before. This will revive confidence in France in the iron trade, stimulate a speedy and vigorous revival and we shall feel the effect of it. A month may pass ere this will be fully developed, but even now the feeling is decidedly better among makers and the trade in this country. It is therefore fair to presume that prices have at length touched bottom. For the moment the market is quiet. The blowing out of some blast furnaces in England has strengthened our Pig Iron market. We quote Common Puddling, 5.30 @ 5.40; Foundry, 6.75; Luxembourg, 4.60; Merchant, 12 for No. 1; 12.75 No. 2, and 13.50 No. 3. Beams, 12.75; Corners, 13.25; Sheets, No. 2, 16.50; No. 18, 18.50; Commercial, 22.50; Thin, 24.50, and No. 4, 26.50.

#### GERMANY.

(Borsenhalles.)

HAMBURG, Jan. 30, 1884.—Iron.—The iron market in Germany has, on the whole, remained dull, both in Pig and Finished, and the aspect would appear gloomy if it were not that the Steel works are so very busy, especially in turning out Steel Rails, the orders for which are unusually large. This activity in Steel manufacture is by some looked upon as a prelude to a good spring trade in iron, too; hence the feeling is rather more confident than it has been at any time since the commencement of the year. Dusseldorf quotes: Spiegel, 60 marks @ ton; Prime White Pig, 53; Luxembourg, 37; Foundry No. 1, 69; No. 2, 64; No. 3, 55; Muelde, 76 @ 78; English No. 3, 56; English Bessemer, 46/6; Spanish, 53 @ 56; German, 55 @ 56; Merchant, 115 @ 140; Sheets, 190 @ 170, and Wire for Wire Nails, 120. Metals have been inactive; Lead is weak at 12.25 @ 12.50 German; Copper is steady at 75.50 Lake Superior; Tin lower, 95 @ 98; Spelter dull at 15.15 @ 15.50.

#### HOLLAND.

(Kock & Vlierboom.)

ROTTERDAM, Jan. 24, 1884.—Tin.—The market has been quiet. We quote Banca from next sale 50.75; Billiton, spot, wanted at 49.50; afloat, 50.12 1/2 @ 50.25 paid.

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The Old Dominion Steamship Company are now having built, at the yards of Messrs. John Roach & Son, Chester, Pa., a steamer of about 2600 to 2700 tons burden. She will be about 300 feet long and similar in many respects to the Guyandotte. She will be launched this summer and take her place in the line early in the fall.

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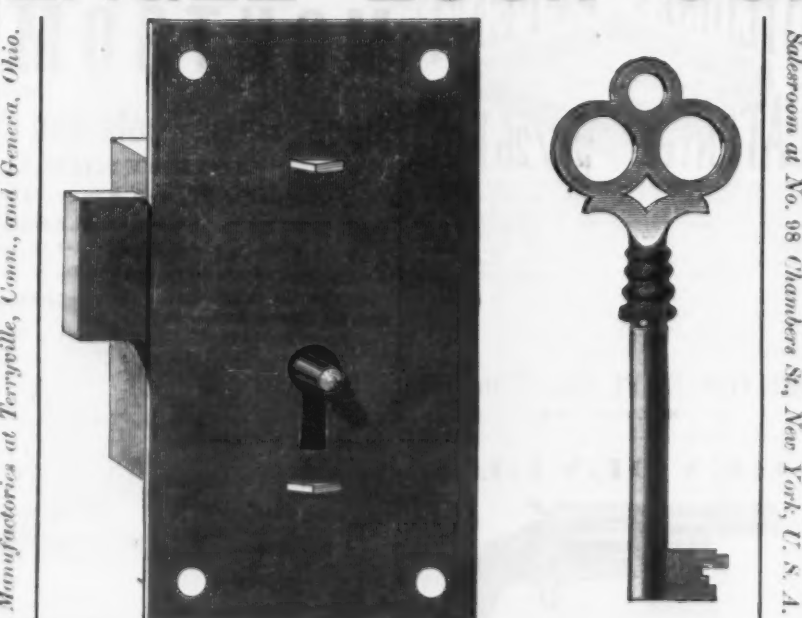
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Back Strap completely below the line of wear.  
Back Strap fitting closely around the point of the handle, positively prevents handle from working loose.



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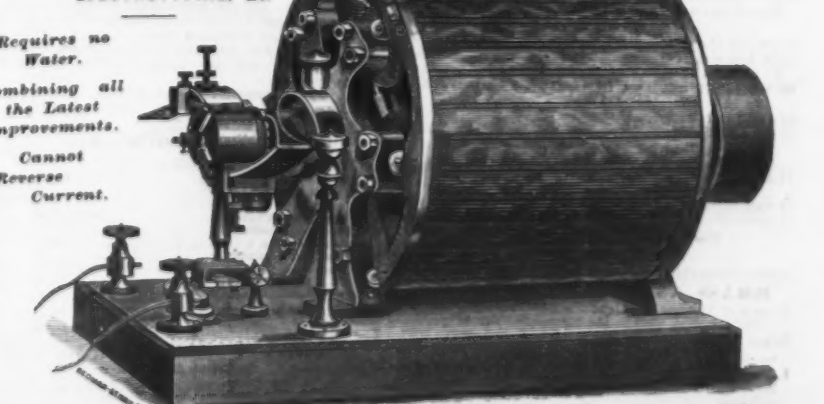
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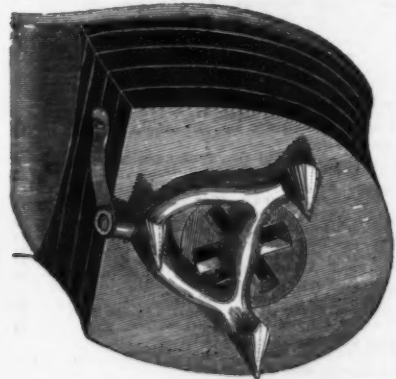
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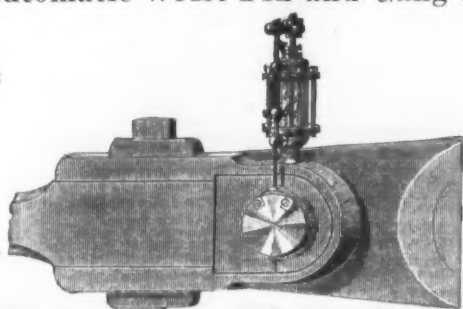
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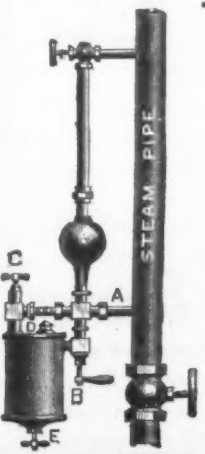
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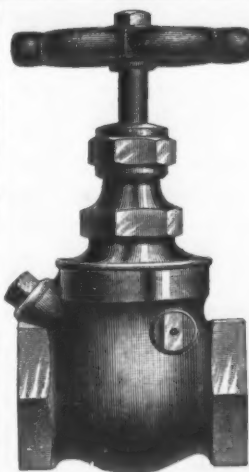
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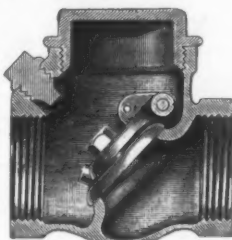
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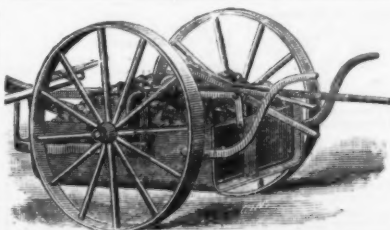
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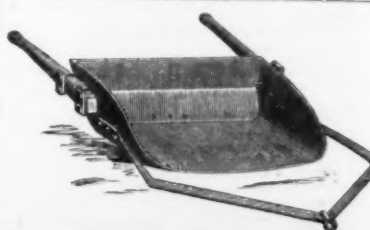
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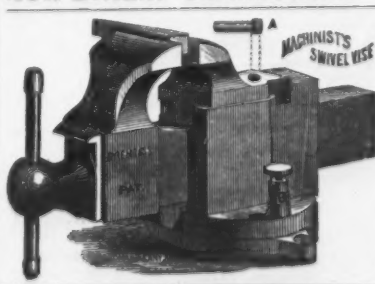
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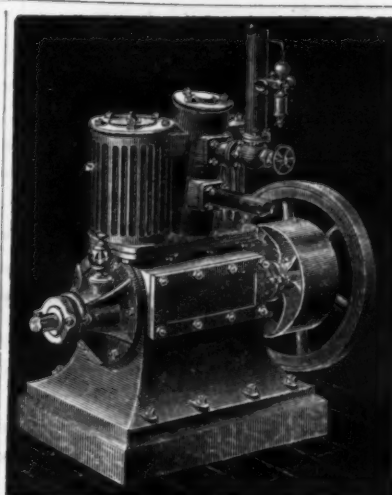
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Not a Bad Start for the New Year!

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Okeechobee Land Co., Centrifugal Pump, Kissimmee, Fla.	125
Ches. O. & S. W. R. R. Car Shops, Paducah, Ky.	100
" " " " " " " " " "	65
" " " " " " " " " "	12
J. & J. Taylor, Safe Works, Toronto, Canada	65
Brush Electric Light Co., Buffalo, N. Y.	65
" " " " " " " " " "	65
" " " " " " " " " "	65
" " " " " " " " " "	65
" " " " " " " " " "	65
" " " " " " " " " "	65
" " " " " " " " " "	65
Givernaud Bros., Silk Mfgs. (2d order), Hackensack, N. J.	50
Smith Hilliard, Saw Mill, East Rupert, Vt.	50
Lafitte, Dudino & Co., Drainage, Hahnville, La.	40
Richard Sauer, Show Cases, Balto., Md.	30
Geo. W. Moyers, Planing Mill (2d order), Altamonte, Fla.	30
Oliver Klingsmith, Tile Mill, New Augusta, Ind.	30
Arndt & Fischer, Machine Shop, Astoria, Oregon	20
S. T. Haviland, Planing Mill (2d order), Clanton, Ala.	20
Levis Cook Carriage Co., Cincinnati, Ohio	20
Wm. Broadhead & Sons, Worsted Mill (2d order), Jamestown, N. Y.	20
Dominion Bridge Co. (2d order), Montreal, Can.	12
Toronto Daily News, Toronto, Canada	12
New York Times, (2d order), New York	12
Tadelge Wettemore & Co., Tannery, Sydney, Australia	12
W. N. Gray, Electric Light, Hamilton, Ohio	8
A. W. Miller, Laundry, La Crosse, Wis.	8
Goulding & Ireland, Planing Mill, Greenacastle, Indiana	8
The E. D. Albro Co., Pishing Mill, Cincinnati, Ohio	8
McTigue Electric Light Co. (3d or.), Pittsburgh, Pa. (4th or.)	4
H. B. Claffin & Co., Dry Goods, New York	4
Number of Engines, 36. Total H. P., 1419 H. P.	

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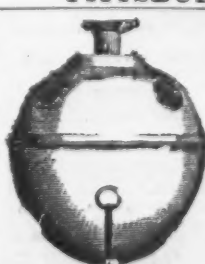
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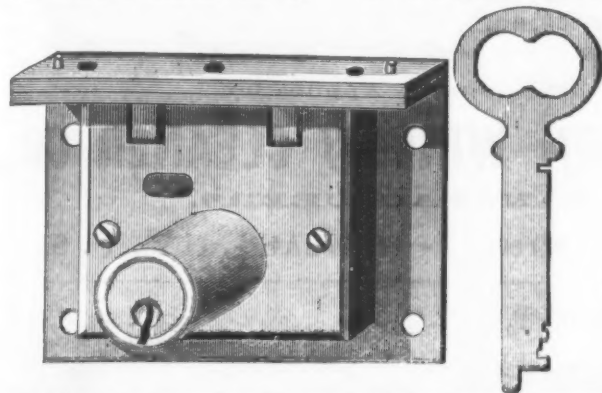
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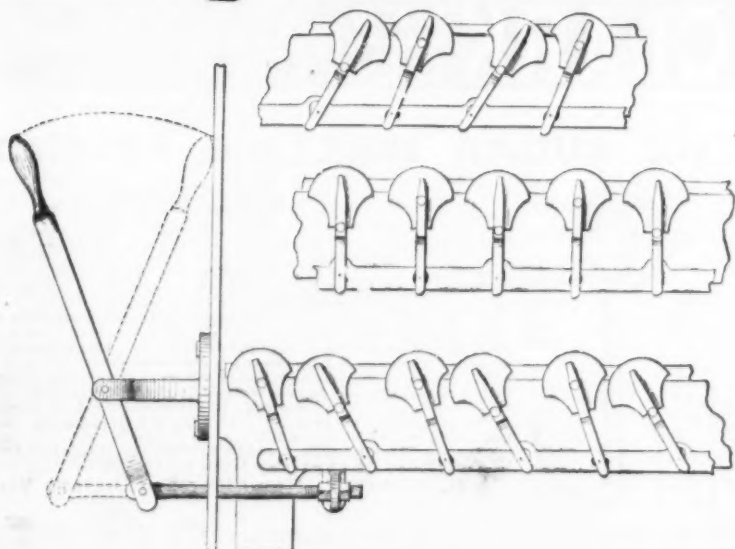
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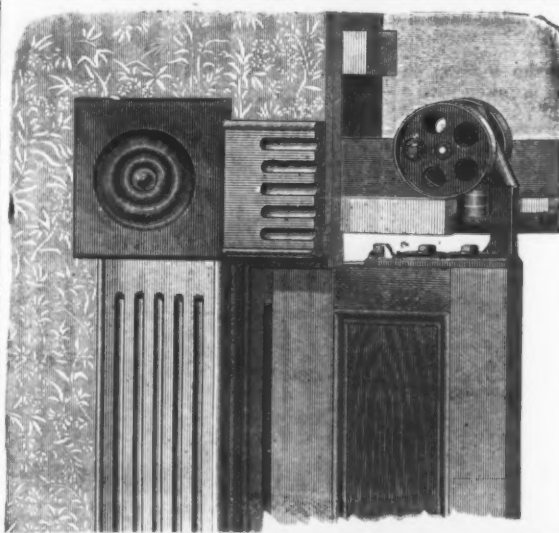
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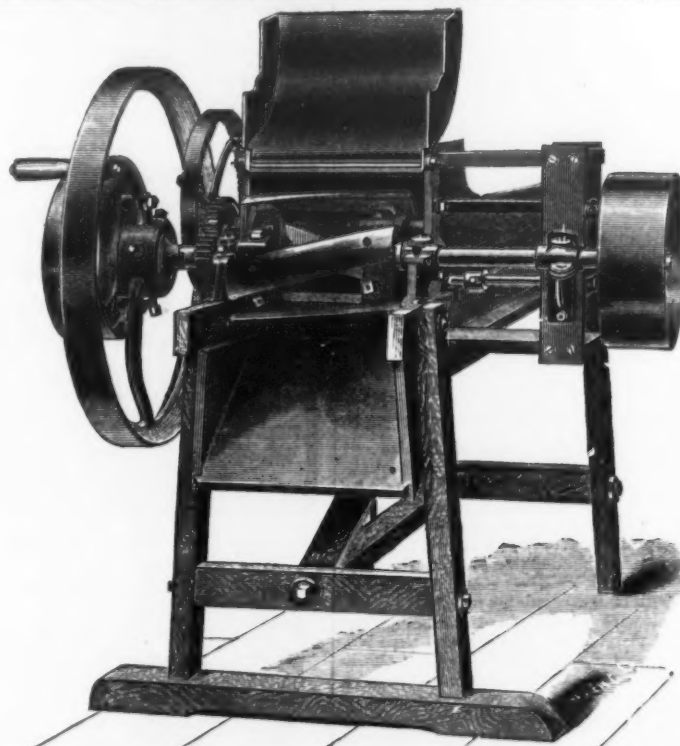
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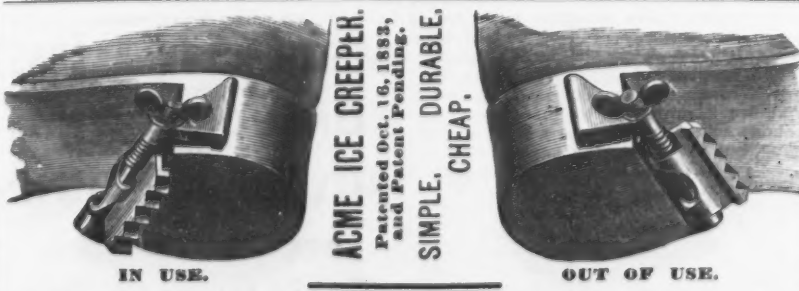
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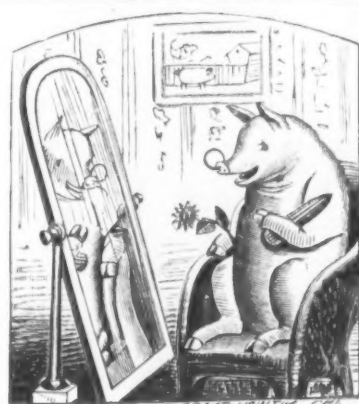
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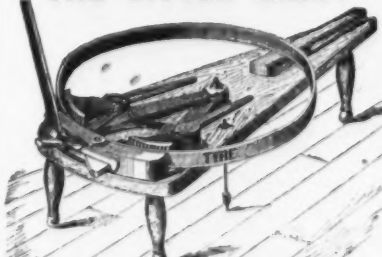
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Contracts Taken for Clearing Lands of Stumps.

**THE HERCULES POWDER COMPANY**  
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## VALUE OF IRON ORES OF DIFFERENT CHEMICAL ANALYSES.

In the tables prepared by Mr. John M. Hartman, and published in the *Bulletin* on December 5, 1883, on the value of iron ores at the blast furnace, the basis is taken with a production of 500 tons of pig iron per week from one furnace using 40 per cent. ores containing 30 per cent. of silica, and allowing the ores to have 20 hours' exposure in the furnace. The plant would cost about \$250,000. The table below, taken from a recent issue of the *Bulletin*, shows the results that would be obtained by using richer ores:

Percentage of Iron in Ores.	Percentage of Silica.															
	1%	2%	4%	6%	8%	10%	12%	14%	16%	18%	20%	22%	24%	26%	28%	30%
Tons of Iron Produced per Week.																
40...	820	784	749	713	677	641	606	570	535	500						
42...	834	798	762	726	690	653	616	580	544							
44...	848	812	775	738	701	664	627	590	553							
46...	862	825	787	750	712	675	637	600	562							
48...	876	838	800	762	724	686	648	610	572							
50...	890	851	812	773	734	695	656	617	578							
52...	904	864	824	784	744	704	664	624	584							
54...	918	877	837	796	755	714	673	632	591							
56...	932	890	849	807	765	723	681	639	597							
58...	946	903	861	818	775	732	689	646	603							
60...	960	916	873	829	785	741	697	653	609							
62...	974	929	885	840	795	750	705	660	615							
64...	988	942	897	851	805	759	713	667	621							
66...	1,002	955	908	861	814	767	720	673	626							
68...	1,016	968	920	872	824	776	728	680	632							
70...	1,030	980	931	882	833	784	735	686	637							

## Tariff Imperfections.

The Ways and Means Committee recently adopted a resolution requesting the Secretary of the Treasury to make such suggestions as he may deem necessary in order to improve the administering of the Customs Department, and to furnish such facts in regard thereto as the committee ought to have in order to perfect suitable amendments to existing laws, looking to their better administration. In accordance to this request the Secretary, on the 11th inst., addressed a letter to Mr. Morrison, chairman of the committee, in which he sets forth at length numerous imperfections in the existing tariff which have given rise to considerable controversy. Those portions of the Secretary's letter which in any way refer to metals or hardware are given below:

Two prominent points have arisen which involve matters of administration. First, as to the order in which the various provisions of Section 2499, Revised Statutes, as amended by that act, shall be applied. It has been decided to apply them in the order in which they stand in the statute, as will be seen by the inclosed copy of letter to the Collector of Customs at New York, dated the 12th ult. It is contended, however, by some of the customs officers, that if an article made of a material which is named in one of the residuary clauses, as, for instance, a manufacture of iron, and not specified in the tariff by its trade name, it is an enumerated article, and hence the first clause in said Section 2499 cannot be applied to subject it to any other rate of duty than that appropriate to the materials of which it is made. The rule adopted is believed to be a proper construction of the law, but it may lead to litigation, and it would be well, if occasion should arise, for Congress to declare how the order in which the various parts of said Section 2499 shall be applied.

The second point of controversy has been the correct meaning of Section 7 of said act. A vast number of appeals from the assessments of duty made by collectors of customs have been filed in this department, growing out of disputes as to the meaning of said section. It is contended by importers and by some of the customs officers that, by virtue of said section, duties were chargeable only on the value of the naked merchandise itself, without reference to any items of expense for placing the merchandise in a marketable condition. Thus, for instance, that shoeblacking which is held for sale in small tin boxes, and matches which are commonly put up for sale in small wooden or paper boxes, are dutiable only on the value of the contents of such boxes. Many instances of the same character might be cited. The inclosed copies of circulars of this department, reports of a commission of customs officers appointed to consider the matter, the members of which, it will be seen, did not agree, and an opinion of the Attorney-General of the 11th ult., will show the various stages of the discussion. The Attorney-General's opinion takes the ground that the value of goods subject to a duty ad valorem is to be taken in the usual merchantable condition of the article as exposed for sale in the foreign country, and that the intent of said Section 7 was to remove only the duties on the items or expense or value which are incidental to the putting-up, packing, transportation for shipment, and any other charges which by Section 2907, Revised Statutes, were added to the foreign market value of the goods to make dutiable value. This opinion has been concurred in by this department, but its enforcement is likely to increase rather than diminish the number of protests from importers, who will seek to enforce in the courts their own views of the law.

At first a difficulty was experienced in construing some of the provisions of Schedule C relating to metals. Paragraph 150 imposes on round iron in coils or rods, less than 7/8 inch in diameter, 7/8 cent per pound. Paragraph 180 imposes on the same class of metals, when valued at 3 1/2 cents or less per pound, 7/8 cent per pound, when within the denomination of rivet, screw, nail or fence wire rods in coils or loops. The class of iron mentioned in 150 is generally available for the purposes mentioned in 180, and the de-

partment has held that when of the size and value specified in 180 it is to be classified for duty thereunder, without any reference to the use to which the merchandise is ultimately applied. This is not stated as a difficulty in administration, but only to explain the position taken by the department on the subject.

182. This clause regulates the duty on iron and steel wire of certain dimensions, but makes no provision for wire larger than No. 5 wire gauge. Wire of that size is therefore remanded to the classification of articles of iron or steel not enumerated, dutiable at 45 per cent., which rate is not in harmony with the duty on the specified sizes of wire.

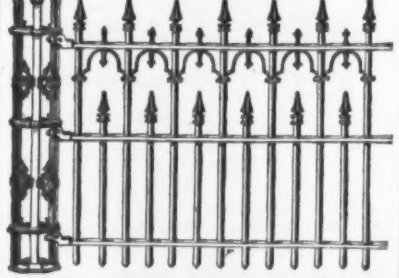
Paragraph 186 imposes a duty of 35 per cent. on all manufactures of copper, or of which copper shall be a component material of chief value, while 216 puts a duty of 45 per cent. on manufactures, articles or wares not specially enumerated or provided for, composed wholly or in part of copper. The ruling of the department in an endeavor to give force to both of these provisions will be found in Decision 5899.

**The Service of Car-Wheels.**—The following facts concerning the relative durability of steel-tired and cast-iron car-wheels are taken from a paper read by Mr. John M. Ford at a meeting of the Master Car-Builders' Club, held at Boston, January 30, and are based on statistics from the passenger-coach service of the Boston and Albany Railroad for the past year: During the year 1883, 180 Hartford steel-tired wheels had been removed as worn out. Their average mileage was 245,980 miles, the minimum being 63,500 and the maximum 470,000 miles; the average time in service, 7 years, 8 months, 3 days. Out of 180 wheels worn out, the great majority, 131, ran over 200,000 miles, and only about 3 per cent. of the total number ran under 100,000 miles. The average mileage of worn-out cast-iron wheels removed during 1882 was 29,074 miles, and it would therefore appear that a steel-tired wheel will outlast eight chilled wheels, which latter only ran, on an average, 332 days. Speaking of the best material for tires, Mr. Ford said crucible steel of good quality, containing about 1 per cent. of carbon, is four times as strong as cast wheel iron, and machinery steel containing about .30 per cent. of carbon gives nearly the same breaking strain, with a fibrous fracture. This metal is too soft for wheel tires, but steel made in crucibles from Swedish iron, with .70 to .80 per cent. of carbon added, hammered and rolled, will produce a perfectly safe and durable tire.

A deplorable accident, resulting in the death of James McBride, of this city, occurred a short time since in the engine-room containing the machinery which propels the Brooklyn Bridge cars. The fly-wheel of the driving engine, making some 56 revolutions per minute, runs through a cut in the pine flooring of the room and almost touches the brick ceiling. McBride, one of the two "wipers" employed, was cleaning the brass guard around this opening, when, in some way not yet explained, he was caught by the wheel and immediately drawn through the cut. The man was probably killed almost instantly, and his remains were found mangled in a horrible manner.

The foundry of Rouelle, in France, which furnishes the Government with large cannon, is at present making some very heavy guns for the French navy and for coast defense. The cannons which are being made are of two kinds, entirely of steel and of brass strengthened with steel hoops. The heaviest weigh, exclusive of carriage, about 100 tons, are charged with some 600 pounds of powder, and fire a projectile weighing over 1700 pounds. The tremendous weight of these guns will necessitate the use of wagons of special construction for their transportation to the coast.

Work was resumed on Monday in the New Jersey Steel and Iron Works, Trenton, employing about 1000 men. They have been shut down since Christmas, ostensibly to allow of repairs in buildings and machinery.

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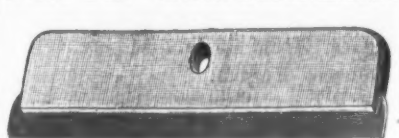
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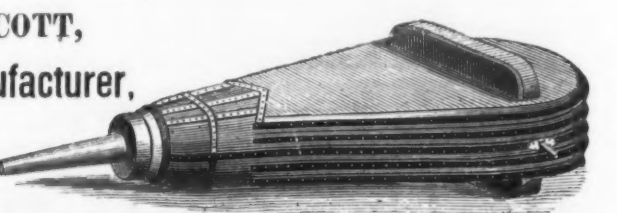
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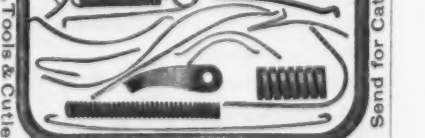


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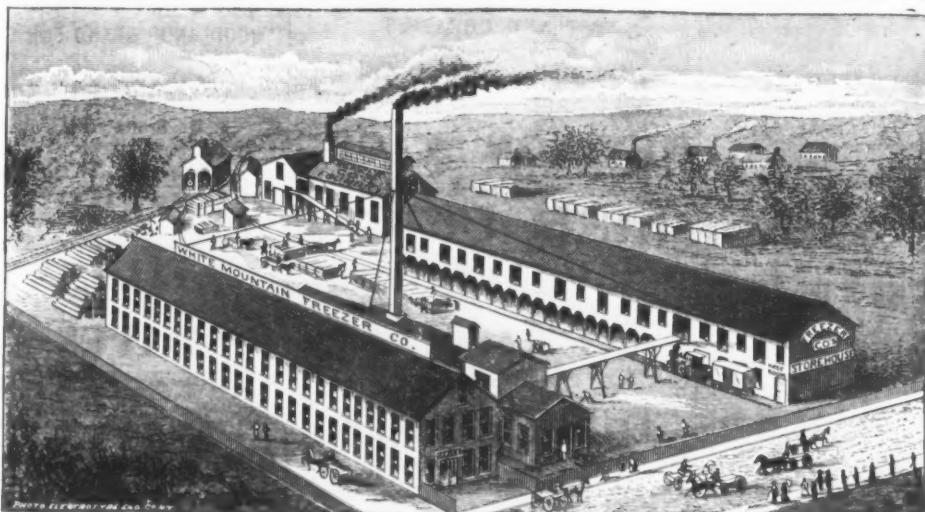
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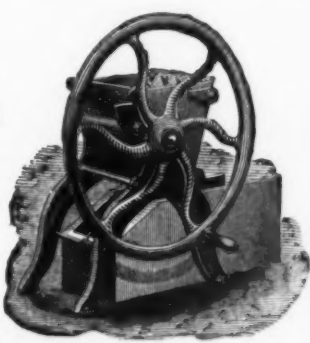
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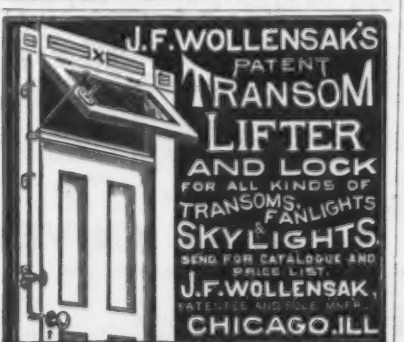
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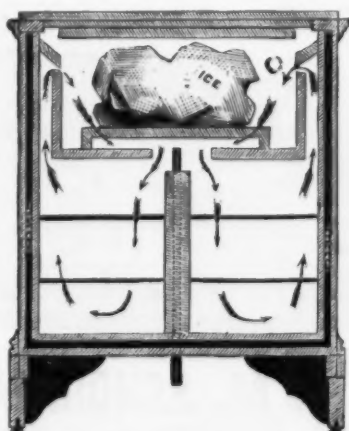
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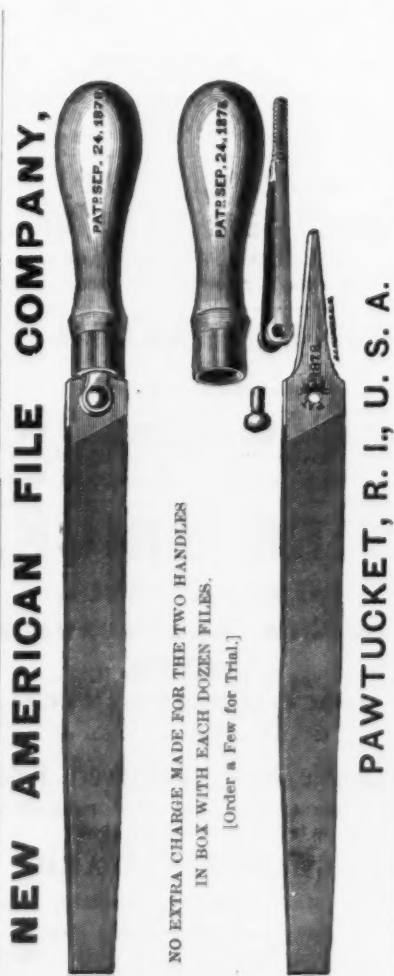
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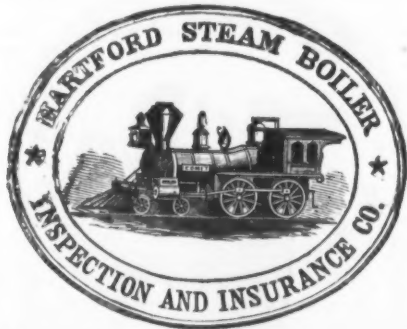
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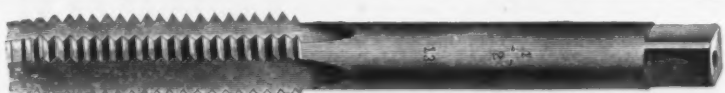
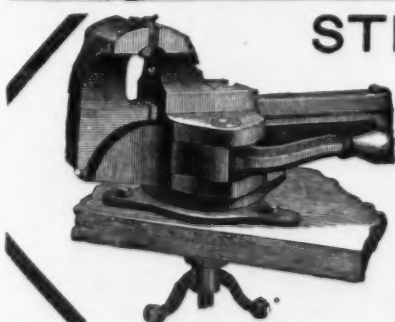
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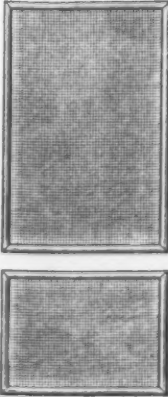
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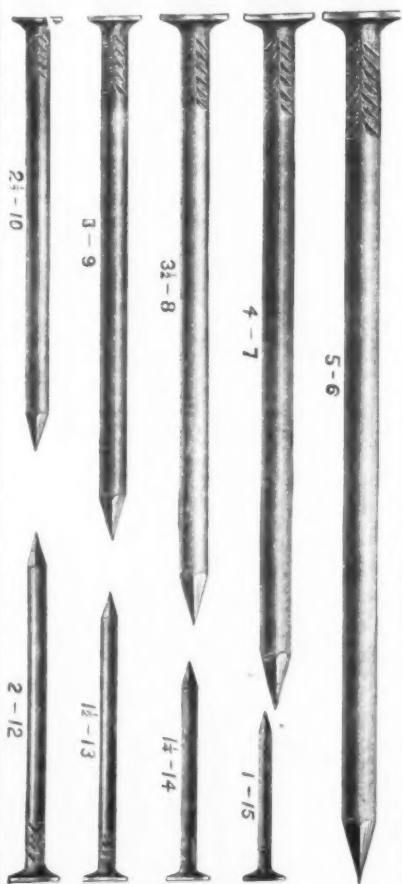
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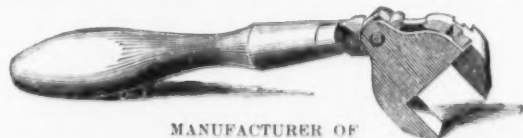
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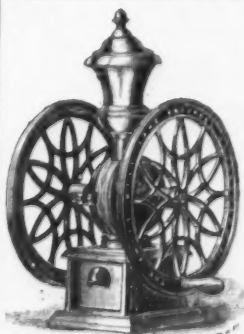
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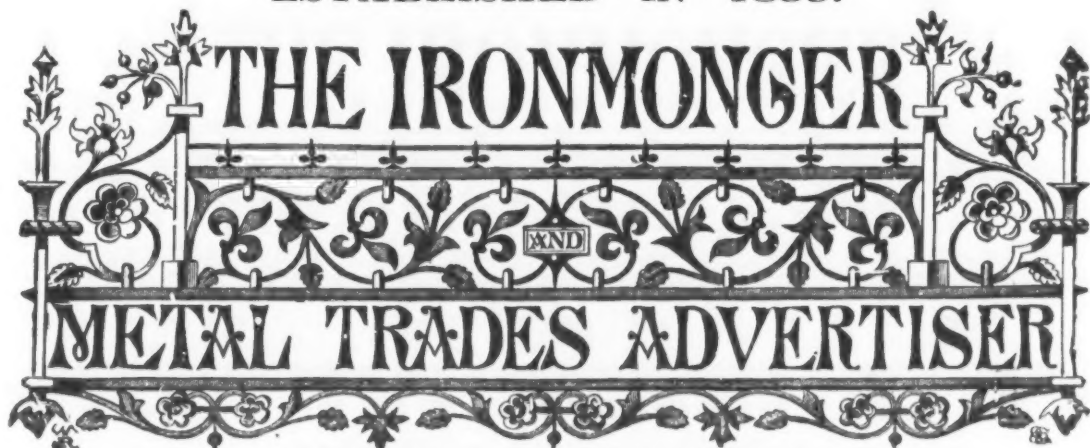
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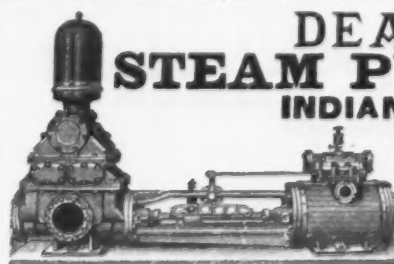
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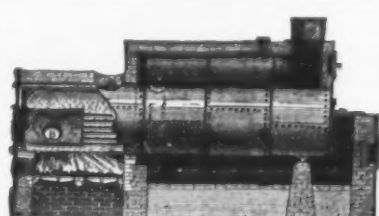
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Boiler Feeders, Fire Pumps,  
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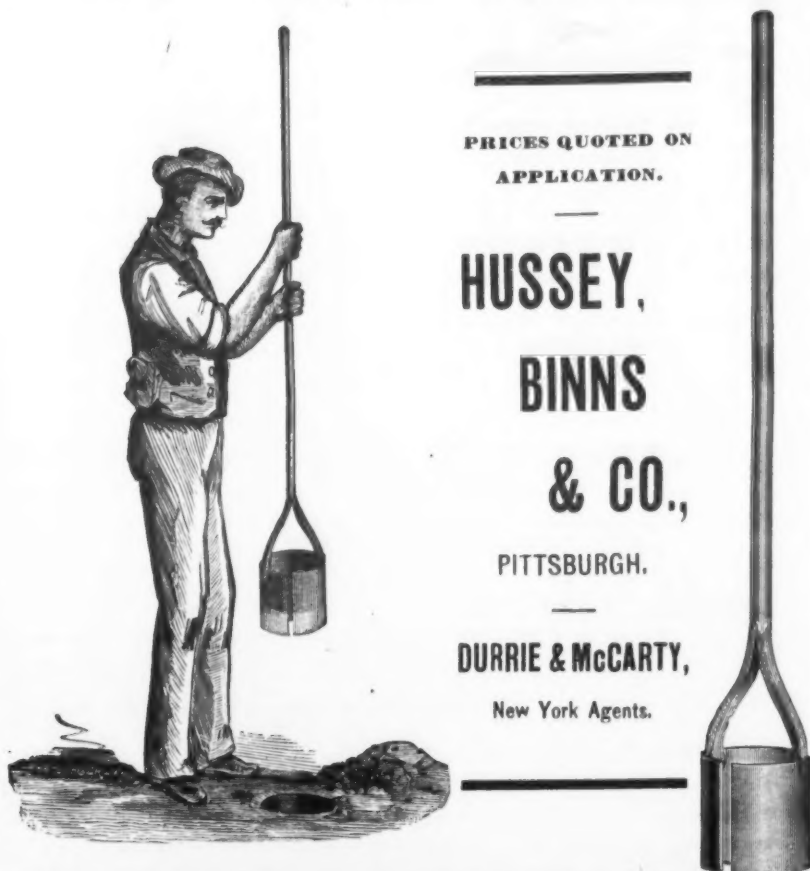
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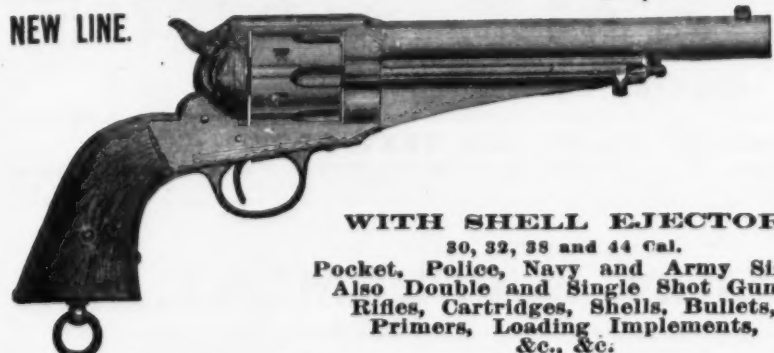
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We are the exclusive manufacturers of  
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We manufacture the only successful Auto-  
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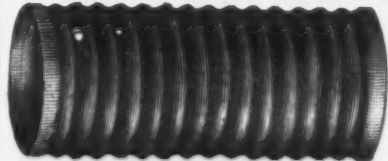


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Since five years 700 steamers were fitted with  
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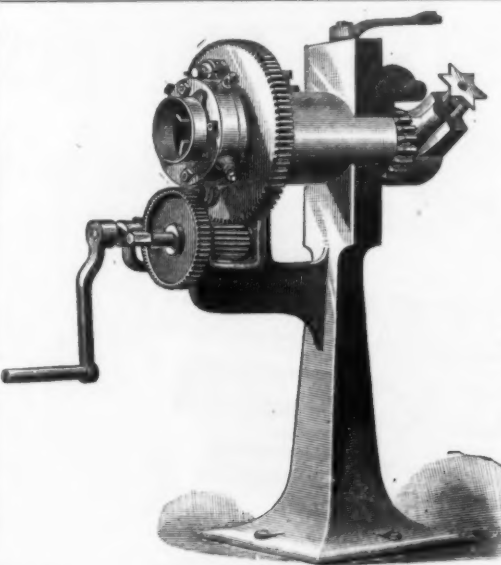
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which are superseding entirely the Tin Lamps  
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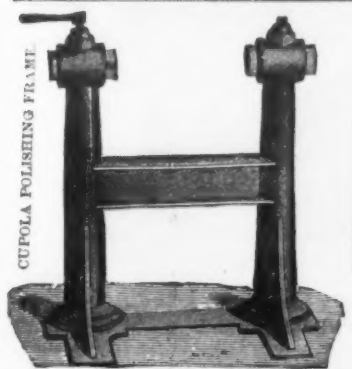
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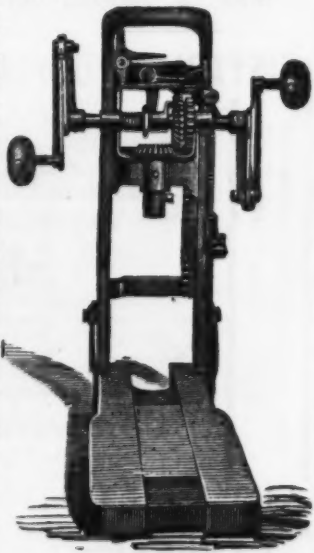
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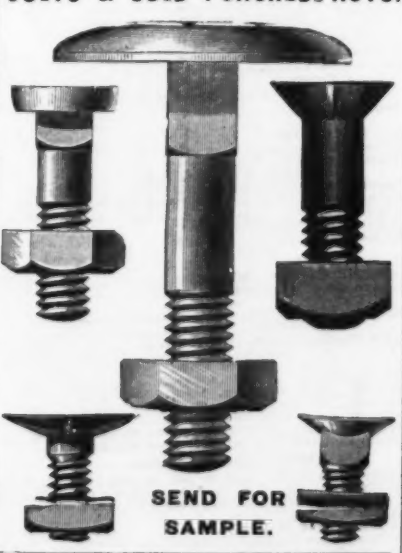
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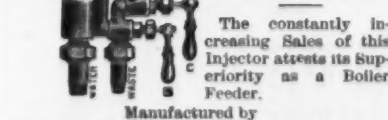
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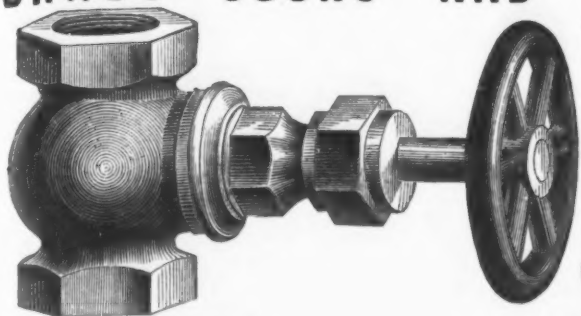
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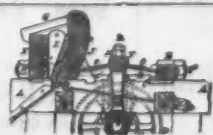
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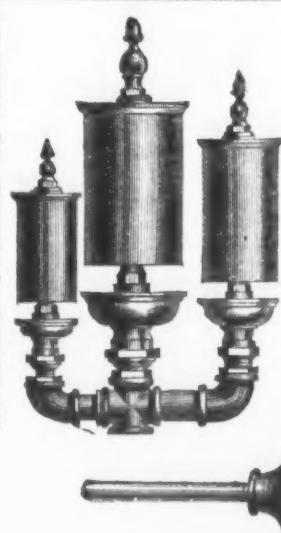
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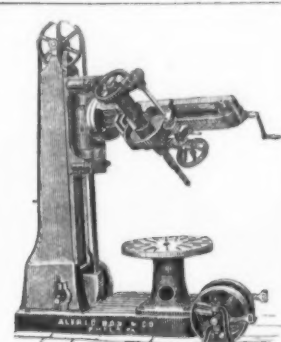
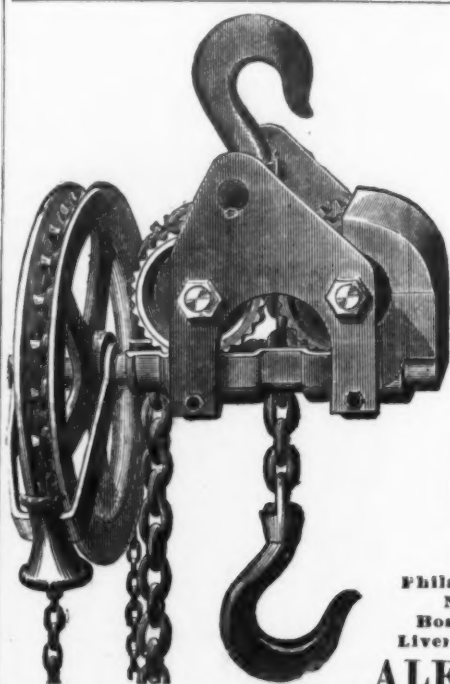
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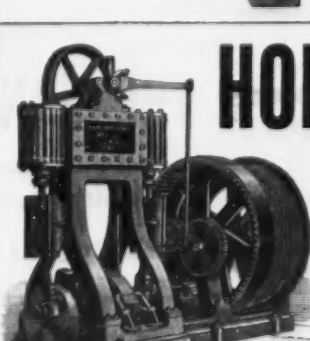
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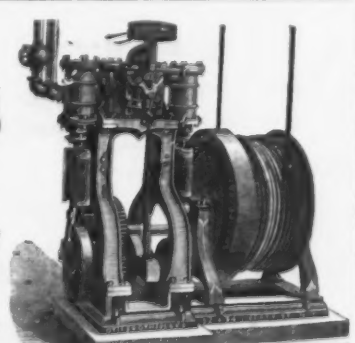
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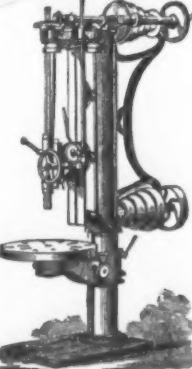
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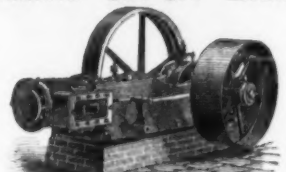
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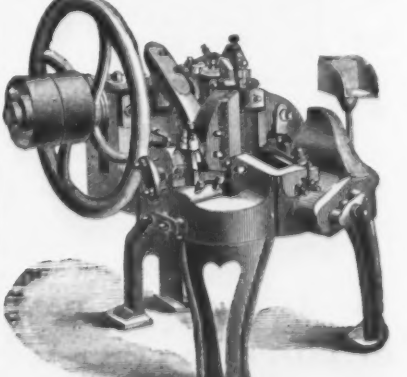
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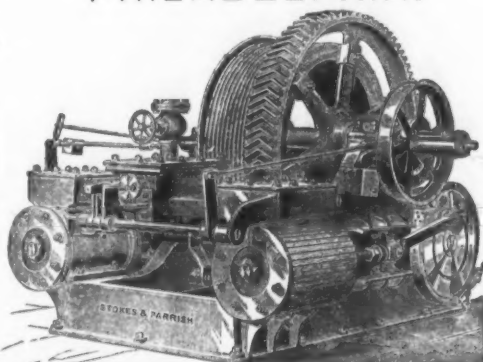
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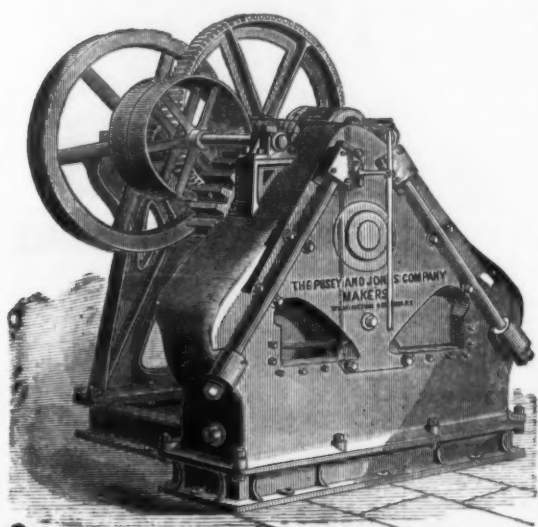
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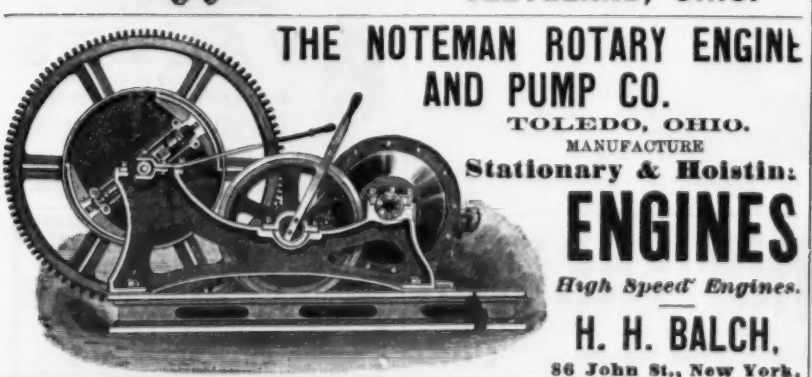
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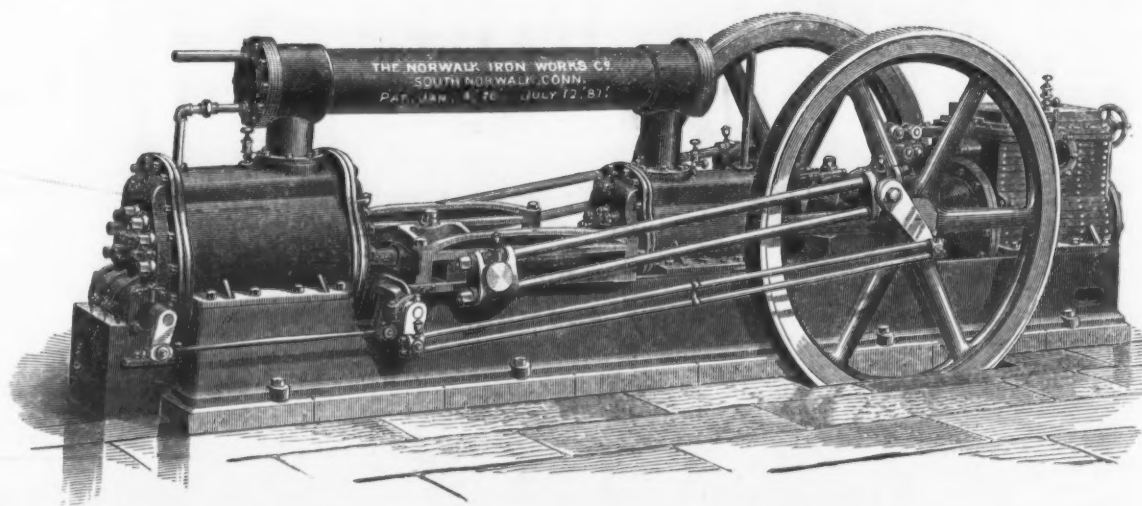
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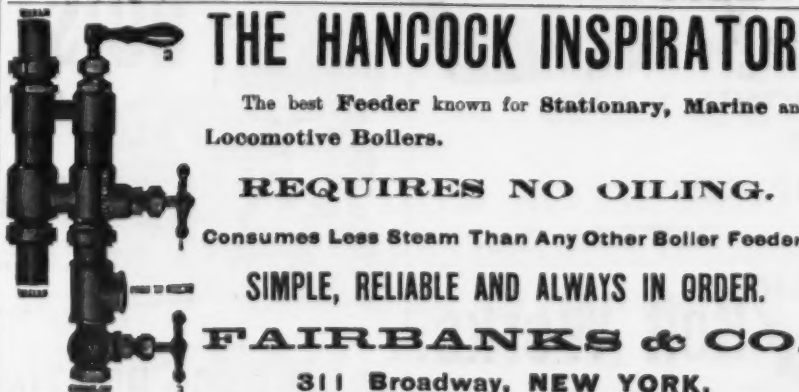
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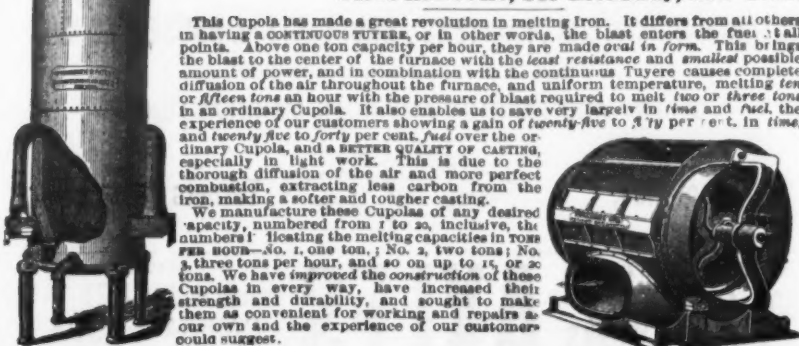
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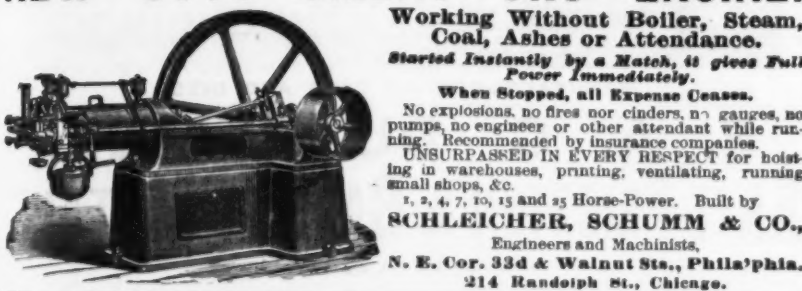
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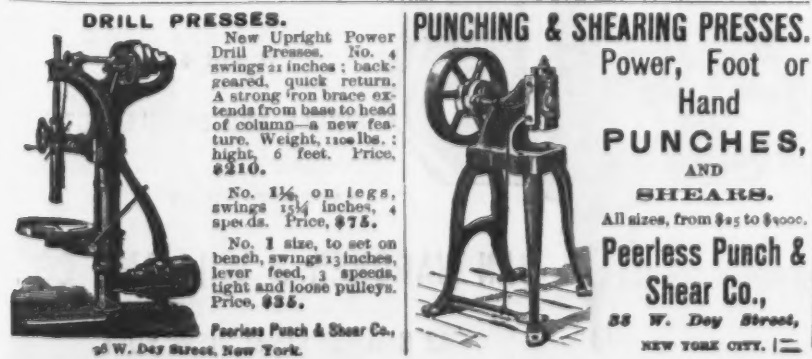


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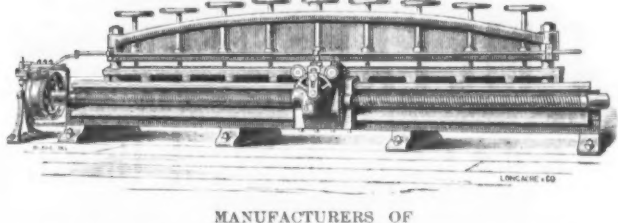
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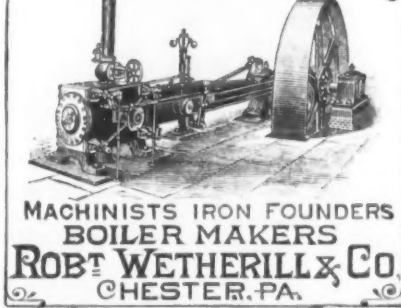
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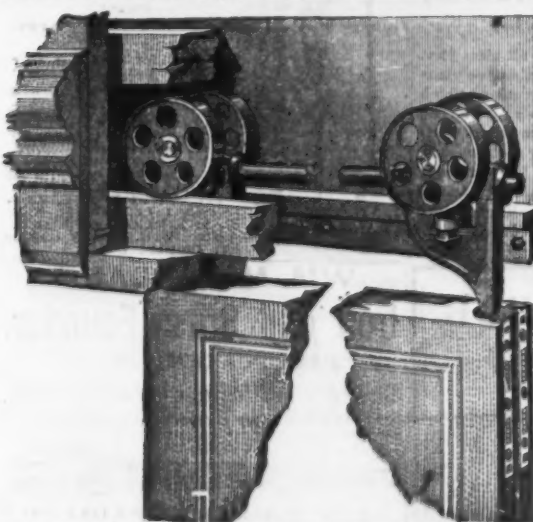
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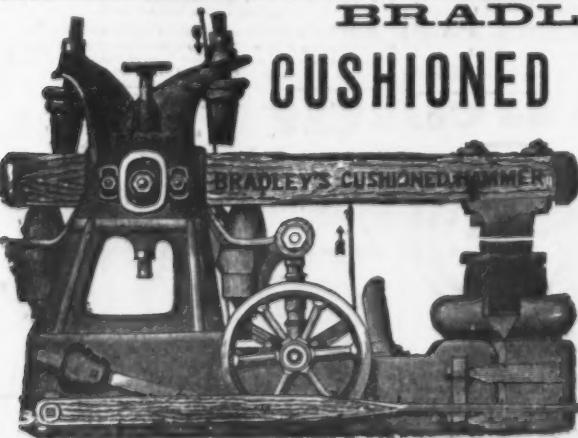
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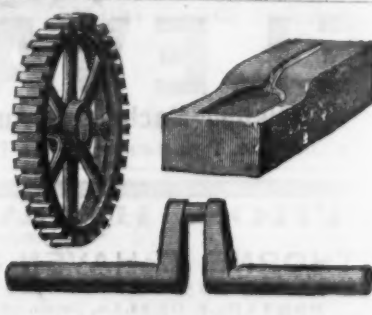
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